

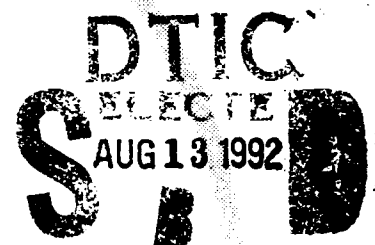
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GNAS Maintenance Control Center (GMCC) Design Qualification Test and Evaluation (DQT&E) Test Report

Richard Van Suetendael



July 1992

DOT/FAA/CT-TN91/39

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16. Abstract This report presents the results of Design Qualification Test and Evaluation (DQT&E) testing of the General National Airspace System (GNAS) Maintenance Control Center (GMCC). As Test Director, ACN-250 conducted testing at the Federal Aviation Administration (FAA) Technical Center, Atlantic City International Airport, New Jersey. The purpose of DQT&E testing is to verify that the phase I and phase II GMCC design requirements are met. The requirements were successfully demonstrated with some minor problems. However, due to an incomplete test configuration, ACN-250 recommended retesting the system with a four GMCC network.					
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EXECUTIVE SUMMARY

This test report describes the results of the Design Qualification Test and Evaluation (DQT&E) of the General National Airspace System (GNAS) Maintenance Control Center (GMCC). The testing was conducted from April 22, 1991, through May 1, 1991, at the Federal Aviation Administration (FAA) Technical Center, Atlantic City International Airport, NJ.

The purpose of DQT&E was to perform phase I and phase II testing of the GMCC. Phase I consisted of verifying that Office Automation Technology and Services (OATS) contractual requirements were met. Phase II consisted of testing the Local Area Network (LAN) interface to the Maintenance Processor Subsystem (MPS), as well as testing the MPS, LAN, and GMCC workstation software functions. Two additional tests were conducted to test network reliability and the effects of loading on the network.

ACN-250, as Test Director, performed testing in accordance with the draft GMCC DQT&E test procedures, dated April 1991. Testing utilized version PCB0702 of the Interim Monitor and Control Software (IMCS) to monitor and send commands to the synchronous Remote Monitoring Subsystem (RMS) simulator. The IMCS software used is resident on the ACN-250 Testbed MPS located at the Federal Aviation Administration (FAA) Technical Center. Testing also utilized commercial off-the-shelf (COTS) software packages resident on the GMCC workstations.

All phase I DQT&E requirements were successfully demonstrated during the OATS MDT evaluation prior to DQT&E testing. The phase I GMCC design is acceptable.

The phase II DQT&E requirements were successfully verified on the GMCC test configurations. (See the Test Verification Requirements Traceability Matrix (TVRTM) in appendix A). The network reliability test proved that all messages/alarms from the synchronous RMS simulator were sent to the GMCC workstations via the MPS with no data loss. The network loading test indicated that eight Maintenance Monitoring Software (MMS)/IMCS sessions and four Tandem Advanced Command Language (TACL) sessions could run simultaneously without system degradation or data loss. Test results also indicated that a GMCC workstation connected to the MPS via a StarLAN network could run the MMS/IMCS software with only minor problems. The only possible major problem is a lack of security, allowing unauthorized access to the StarLAN server.

Only one complete GMCC (with modems and Brouters) and two direct-connect (MultiLAN Adapter to StarLAN Hub) configurations were tested. A configuration with four complete GMCC networks must be tested before ACN-250 will recommend accepting the system.

At the start of testing, the GMCC network and software configurations were unclear. Datronics/American Telephone and Telegraph (AT&T) and TANDEM representatives generated draft configuration documentation (appendix B) during testing. Any changes to the configuration will necessitate additional DQT&E testing.

Problems discovered during testing did not significantly impact system operation. Each problem was recorded as a Program Trouble Report (PTR). A complete set of PTRs for GMCC DQT&E can be found in appendix C of this test report. The following list briefly describes the problems encountered during testing and their corresponding PTRs:

- a. The GMCC workstation could not access UNIX on the server because the Kermit application was not functional (PTR-01).
 - b. A keyboard lockup sometimes occurred when a screen update was received at the same time a key entry was made (PTR-02).
 - c. The PackRat application was not available (PTR-03).
 - d. The Back-It application did not work as expected (PTR-04, PTR-05).
 - e. The IMCS reports could not be printed from the network printer (PTR-06).
 - f. Printing MMS reports from the shared printer could only be accomplished if the MMS session was exited from after requesting a report (PTR-07).
 - g. A random error was generated when multiple data points were monitored or unmonitored (PTR-08).
 - h. An invalid password entry on the GMCC workstations did not prevent the user from gaining access to the network and its applications. Although MMS/IMCS has adequate security protection, unauthorized access to the StarLAN server and network, which allows access to the MPS, is not desirable. This could be considered a major problem (PTR-09).
 - i. A continuous beep occurred at workstations running two simultaneous IMCS Constant Monitor sessions (PTR-10).
 - j. A 25th line message was not displayed on the GMCC workstation (PTR-11).
 - k. The StarLAN server tape backup unit was not tested. Documentation on the tape backup unit was not available.
 - l. Failure mode testing and the useability of GMCC software applications should be evaluated before a design acceptance decision is made.
- ACN-250 recommends that DQT&E be repeated when a complete GMCC configuration (four GMCC LANs connected to a single MPS) and all phase II application functions (including status board and weather) are available.

1. INTRODUCTION.

This test report details the results of the Design Qualification Test and Evaluation (DQT&E) of the General National Airspace System (GNAS) Maintenance Control Center (GMCC). As Test Director, ACN-250 performed testing in accordance with the draft GMCC DQT&E test procedures, dated April 1991. The testing utilized version PCC0702 of the Interim Monitor and Control Software (IMCS) to remotely monitor and send commands to the synchronous Remote Monitoring Subsystem (RMS) simulators. The IMCS software used is resident on the ACN-250 testbed Maintenance Processor Subsystem (MPS) located at the Federal Aviation Administration (FAA) Technical Center. Testing also utilized commercial off-the-shelf (COTS) software packages resident on the GMCC workstations.

At the start of testing, the GMCC network and software configurations were unclear. Datronics/American Telephone and Telegraph (AT&T) and TANDEM representatives generated draft configuration documentation (appendix B) during testing. Any changes to the configuration will necessitate additional DQT&E testing.

1.1 BACKGROUND.

The GMCC will provide continuous real-time automation support to FAA maintenance personnel for the monitoring, control, and maintenance of FAA facilities, systems, and equipment. The GMCC will centralize the management and control of maintenance operations for all National Airspace System (NAS) facilities under GMCC jurisdiction. In addition, the GMCC will automate maintenance operations including certification and preventative maintenance.

1.2 PURPOSE.

The purpose of GMCC DQT&E was to verify the following:

- a. The phase I functionality requirements of the GMCC are satisfied by the software and hardware elements procured under the FAA Office Automation Technology and Services (OATS) contract.
- b. The GMCC meets the phase II requirements defined in the GMCC Type A System Specification, FAA-E-2875, and NAS System Specifications, NAS-SS-1000 (Volumes I and V), as outlined in the Test Verification Requirements Traceability Matrix (TVRTM) found in appendix A.

1.3 TEST TIME AND LOCATION.

The GMCC was tested from April 22 through May 1, 1991, at the FAA Technical Center in Atlantic City, NJ.

1.4 TEST PARTICIPANTS.

The participants in the GMCC DQT&E were as follows:

- | | |
|---------------------------|----------------|
| a. Bill Gibbons | Tandem |
| b. Andy Howard | Datronics/AT&T |
| c. Alan Jarvis | Datronics/AT&T |
| d. Mike Jones | ACN-250/CTA |
| e. Danny Rasdall | ASM-450 |
| f. Julie Riches | ACN-250/CTA |
| g. Craig Stewart | ACN-250/CTA |
| h. Richard Van Suetendael | ACN-250 |

1.5 RELATED DOCUMENTATION.

1.5.1 GMCC Program Documentation.

- a. GMCC Type A System Specification, FAA-E-2875, December 5, 1990, DOT/FAA.
- b. GMCC Type B1 Prime Item Specification, FAA-XX-XXX, June 22, 1990, DOT/FAA.
- c. Draft GMCC DQT&E Test Procedures, April 1991, ACN-250/FAA.

1.5.2 RMMS Program Documentation.

- a. NAS System Specification, Functional and Performance Requirements for the National Airspace System General, NAS-SS-1000, Volume I, December 1986, DOT/FAA.
- b. NAS System Specification, Functional and Performance Requirements for the National Airspace System Maintenance and Operations Support Element, NAS-SS-1000, Volume V, December 1986, DOT/FAA.
- c. Remote Maintenance Monitoring System Interface Control Document, Maintenance Processor Subsystem to Remote Monitoring Subsystems and Remote Monitoring Subsystem Concentrator, NAS-MD-790, June 10, 1986, DOT/FAA.
- d. Functions and Operational Requirements of the NAS Maintenance Control Center, NAS-MD-794, March 15, 1986, DOT/FAA.

1.5.3 Other Documentation.

- a. Draft Design Qualification Test Plan for the GNAS MCC, June 18, 1990.
- b. NAS Operational Test and Evaluation/Integration of the Interim Monitor and Control Subsystem Test Procedures, October 1990.
- c. MDT OATS Procurement Evaluation Test Report, August 1990, ACN-230/FAA.
- d. GMCC Integration Document (DRAFT), April 1991, Datronics/AT&T Federal Systems.
- e. Documentation for Testing of MULTILAN/STARLAN (DRAFT), April 1991, TANDEM Computers, Inc.

2. TEST CONFIGURATIONS.

The phase I Design Qualification Test (DQT) configuration is presented in figure 2-1. Most Phase I requirements were successfully tested during the Maintenance Data Terminal (MDT) evaluation of the OATS equipment. (See the MDT OATS Procurement Evaluation Test Report, dated August 1990.)

The phase II DQT configurations are shown in figures 2-2 and 2-3. The DQT sequences were performed twice; once for the configuration depicted in figure 2-2 and once for the configuration depicted in figure 2-3. The GMCC Loading Test, DQT3.11, and GMCC Network Reliability Test, DQT3.12, were conducted only for the configuration depicted in figure 2-3. Note that the FAA-E-2875 (GMCC Type A System Specification) phase II requirement is for up to four GMCCs connected to a single MPS. This configuration was not available for testing. Appendix B, which was prepared by Datronics/AT&T and TANDEM representatives, presents the DQT&E phase II GMCC configuration with network attributes.

The following hardware and/or software was used to perform the DQTs:

- a. OATS GMCC workstation hardware consisting of an 80386 25 megahertz (MHz) processor, 4 megabyte (Mb) of Random Access Memory (RAM), 90 Mb hard disk, 3.5"/1.44 Mb and 5.25"/1.22 Mb floppy disk drives, Video Gate Array (VGA) color monitor, 10 Mb StarLAN Network Adapter Unit (NAU) card, keyboard, Microsoft mouse, and 2400 bits per second (bps) modem.
- b. OATS GMCC graphics workstation hardware consisting of an 80386 25 MHz processor, 4 Mb of RAM, 90 Mb hard disk, 3.5"/1.44 Mb and 5.25"/1.22 Mb floppy disk drives, video graphics card and 19" Mitsubishi HL6915STK color monitor, 10 Mb StarLAN Network Adapter Unit (NAU) card, keyboard, and Microsoft mouse.
- c. OATS server hardware consisting of an 80386 25 MHz processor 8 Mb of RAM, 150 Mb hard disk, 3.5"/1.44 Mb and 5.25"/1.22 Mb floppy disk drives, VGA color monitor, 10 Mb StarLAN NAU card, Hi-Capacity Internal Tape Cartridge, and keyboard.
- d. Multi-LAN Adapter Device (MLAD) Unit consisting of an 80286 processor, 20 Mb hard disk, 5.25"/1.2 Mb floppy disk drive, monochrome monitor, 10 Mb StarLAN NAU card, 3-COM adapter card, and keyboard.
- e. AT&T StarLAN 10 Network Hub Unit (NHU).
- f. StarWAN 200 Routers with X.25 and bridging software.
- g. Codex 3600 modems.
- h. AT&T StarLAN 10 Network Auxiliary Unit Interface (AUI) Adapters.
- i. Accel-500 dot matrix printer.
- j. OATS workstation resident software including: AT&T StarGROUP Client (Version 3.3), AT&T MS-DOS (Version 3.3), Microsoft Windows (Version 3.0), Microsoft Word for Windows (Version 1.1), Microsoft Excel (Version 3.0), Precision Software Ltd. Superbase 4 (Version 1.21), TANDEM PC6530 Terminal Emulation software (Version G21), Gazelle Systems Back-It (Version 3.1), Polaris Software PackRat (Version 3.0), and Columbia University Kermit (Version 2.32), used to access AT&T UNIX System V/386 Release 3.2.2 on server.

k. OATS server resident software including: AT&T StarGROUP Server (Version 3.3 for eight users), UNIX System V/386 Release 3.2.2.

l. Two synchronous RMS simulators configured as Air Traffic Control Beacon Interrogation (ATCBI)-5 sites.

m. MPS running IMCS software (Version PCC0702) married to the MMS software; used to monitor/control the synchronous RMS simulator operations.

n. Protocol Analyzer (LM-1 Version 7.0) software resident on a Compaq II portable computer; used to monitor/record RS-232 message transmission between the MPS and RMS simulator.

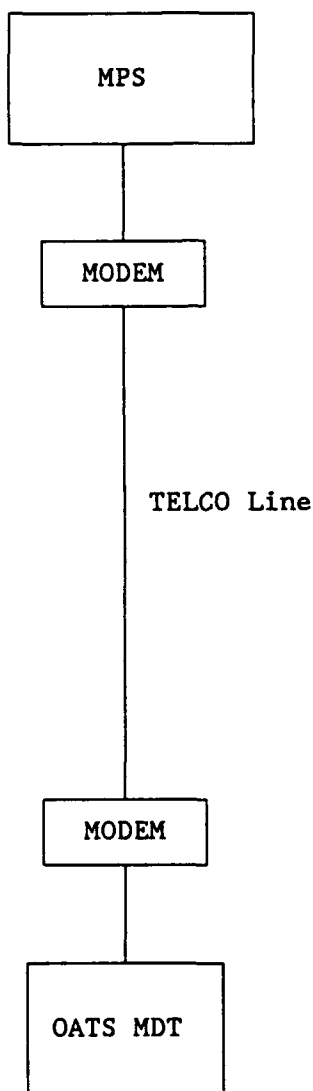


FIGURE 2-1. PHASE I GMCC CONFIGURATION

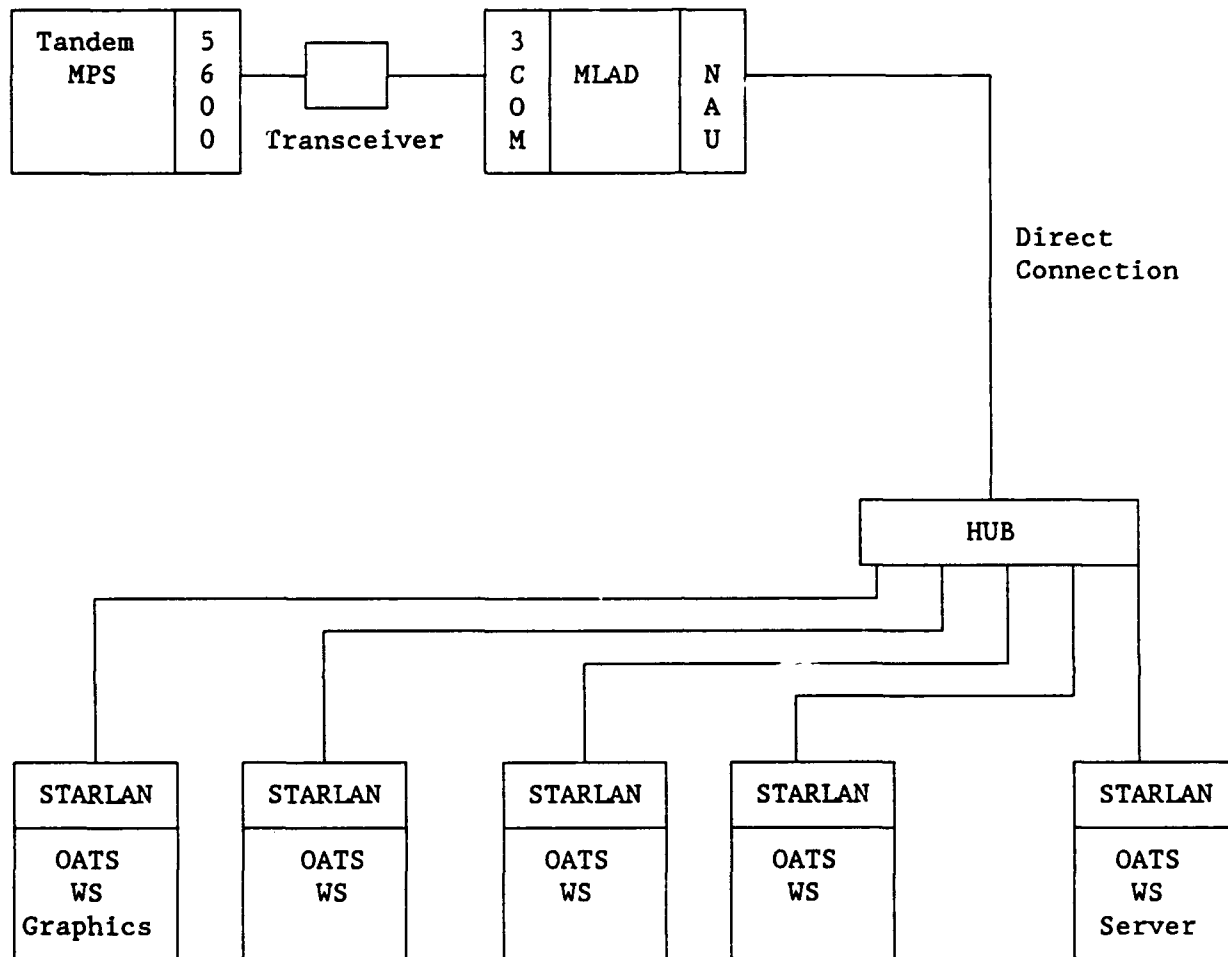


FIGURE 2-2. PHASE II GMCC CONFIGURATION #1

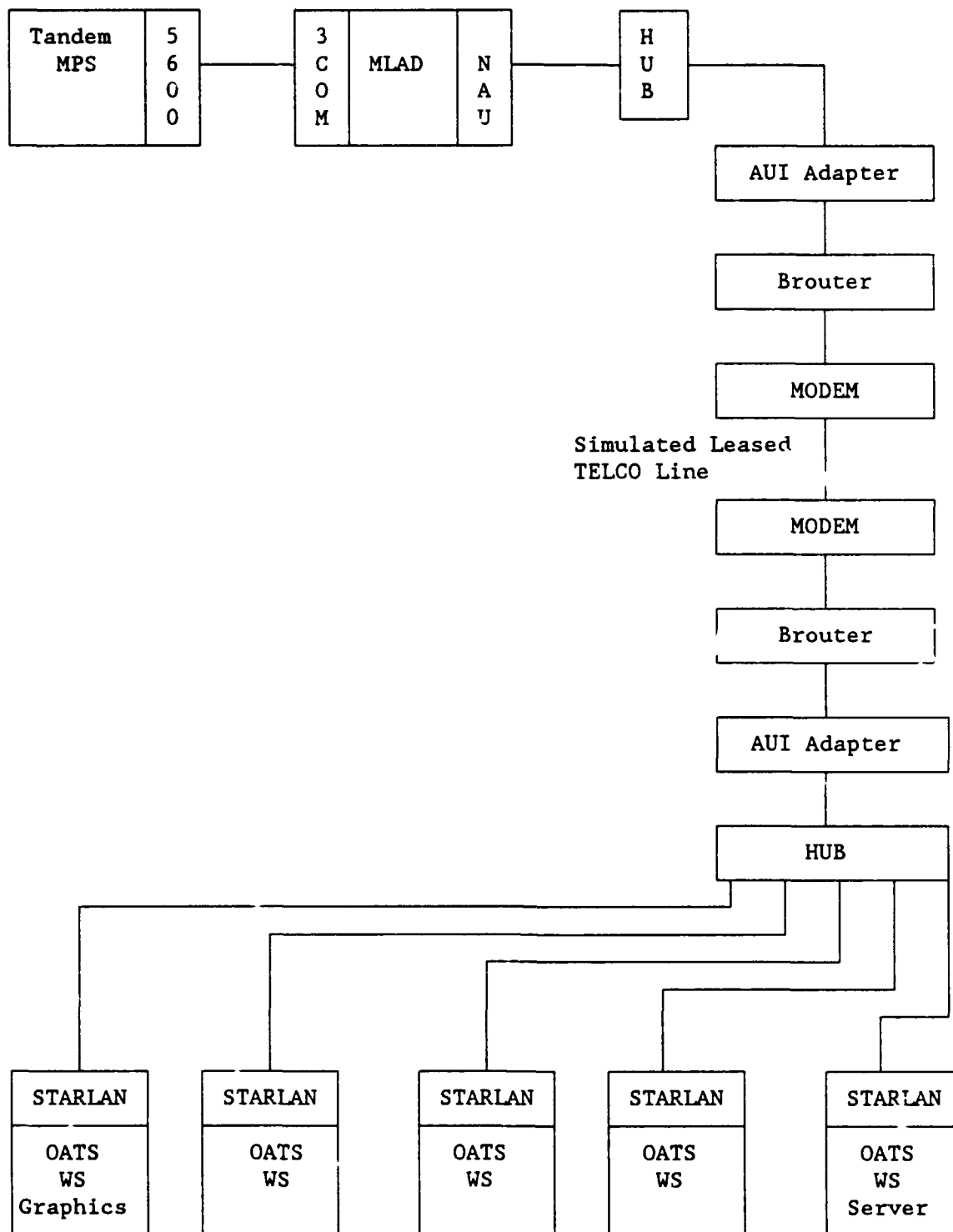


FIGURE 2-3 - PHASE II GMCC CONFIGURATION #2

3. TEST RESULTS AND RECOMMENDATIONS.

The results from each of the DQT sequences for phase II are presented in this section. The test purpose, results, and corresponding recommendations (if applicable) are provided for each test sequence. Program Trouble Reports (PTRs) are provided in appendix C.

3.1 DQT1 COMPONENT INSPECTION, INITIALIZATION, INTEGRATION, AND CHECKOUT TEST.

The DQT1 verified that each GMCC component was undamaged and operational. Each component was examined for external physical damage prior to power up or connection to any other component. This test was performed by AT&T as part of Phase I testing.

The DQT1 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed for each workstation. However, due to hardware limitations, only one complete GMCC network could be configured (see figure 2-3).

3.2 DQT2 LOCAL AREA NETWORK FUNCTIONAL CHECKOUT TEST.

The DQT2 verified that all communications connections/interfaces were operational. The DQT2 also verified that COTS software installed on the Local Area Network (LAN) operated in a manner prescribed by the manufacturer's documentation.

The DQT2 consisted of 11 test sequences: DQT2.1 Network Administration Test, DQT2.2 LAN Checkout, DQT2.3 MS-DOS Software Checkout, DQT2.4 AT&T UNIX V Software Checkout, DQT2.5 Microsoft Excel Software Checkout, DQT2.6 PC6530 Emulation Software Checkout, DQT2.7 Superbase 4 Software Checkout, DQT2.8 PackRat Software Checkout, DQT2.9 Back-It Software Checkout, DQT2.10 Word for Windows Checkout, and DQT2.11 Microsoft Windows Software Checkout.

3.2.1 DQT2.1 Network Administration Test.

3.2.1.1 DQT2.1 Network Administration Test Purpose.

The DQT2.1 verified that system administration functions could be performed from the network server.

3.2.1.2 DQT2.1 Network Administration Test Results.

The DQT2.1 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on the network server. One problem was identified during this test:

- a. An incorrect password was accepted by the StarLAN network. Unauthorized access to the StarLAN server is undesirable. This could be considered a major problem (PTR-09).

3.2.2 DQT2.2 LAN Checkout Test.

3.2.2.1 DQT2.2 LAN Checkout Test Purpose.

The DQT2.2 verified that general StarLAN network commands could be performed at each GMCC workstation. Links to the server were established and verified. Terminal messages were sent and received at each workstation. Existing links and servers in use were displayed upon request. This test sequence also verified that the NAU Statistics program and the Reconfiguration program were accessible and functional.

3.2.2.2 DQT2.2 LAN Checkout Test Results.

The DQT2.2 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test sequence.

3.2.3 DQT2.3 MS-DOS Software Checkout Test.

3.2.3.1 DQT2.3 MS-DOS Software Checkout Test Purpose.

The DQT2.3 verified that MS-DOS Version 3.3 was resident and functional on each GMCC workstation. The basic MS-DOS commands were issued and the results recorded.

3.2.3.2 DQT2.3 MS-DOS Software Checkout Test Results.

The DQT2.3 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test sequence.

3.2.4 DQT2.4 UNIX V Software Checkout Test.

3.2.4.1 DQT2.4 UNIX V Software Checkout Test Purpose.

The DQT2.4 verified that the UNIX V Operating System (OS), resident on the server, was accessible through the KERMIT communication application on each GMCC workstation.

3.2.4.2 DQT2.4 UNIX V Software Checkout Test Results.

Because the KERMIT application was not functional, DQT2.4 could not be completed (PTR-01). It is believed that KERMIT is not compatible with the version of LAN software being used.

3.2.5 DQT2.5 Microsoft Excel Software Checkout Test.

3.2.5.1 DQT2.5 Microsoft Excel Software Checkout Test Purpose.

The DQT2.5 verified that Microsoft Excel (Version 3.0) software was resident and functional on each GMCC workstation.

3.2.5.2 DQT2.5 Microsoft Excel Software Checkout Test Results.

The DQT2.5 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test sequence.

3.2.6 DQT2.6 Tandem PC6530 Software Checkout Test.

3.2.6.1 DQT2.6 Tandem PC6530 Software Checkout Test Purpose.

The DQT2.6 verified that Tandem PC6530 (Version G21) software was resident and functional on each GMCC workstation and that access to Maintenance Monitoring Software (MMS)/IMCS is permitted via the PC6530 application.

3.2.6.2 DQT2.6 Tandem PC6530 Software Checkout Test Results.

The DQT2.6 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test sequence.

3.2.7 DQT2.7 Superbase 4 Software Checkout Test.

3.2.7.1 DQT2.7 Superbase 4 Software Checkout Test Purpose.

The DQT2.7 verified that Superbase 4 software (Version 1.21) was resident and functional on each GMCC workstation.

3.2.7.2 DQT2.7 Superbase 4 Software Checkout Test Results.

The DQT2.7 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test sequence.

3.2.8 DQT2.8 PackRat Software Checkout Test.

3.2.8.1 DQT2.8 PackRat Software Checkout Test Purpose.

The DQT2.8 verified that PackRat software was resident and functional on each GMCC workstation.

3.2.8.2 DQT2.8 PackRat Software Checkout Test Results.

Because the PackRat application was not resident on the network, DQT2.8 could not be completed (PTR-03).

3.2.9 DQT2.9 Back-It Software Checkout Test.

3.2.9.1 DQT2.9 Back-It Software Checkout Test Purpose.

The DQT2.9 verified that the Back-It (Version 3.1) software was resident and functional on each GMCC workstation.

3.2.9.2 DQT2.9 Back-It Software Checkout Test Results.

The DQT2.9 was performed in accordance with the GMCC DQT&E test procedures. The DQT2.9 test sequences were completed on each GMCC workstation. Testing revealed the following problems:

a. The floppy diskette format worked inconsistently (PTR-04).

b. The disk backup procedure defaults to the A: drive when the user specifies the backup for the B: drive. This occurred only on the first attempt. The second attempt at backing up was successful (PTR-05).

3.2.10 DQT2.10 Microsoft Word Software Checkout Test.

3.2.10.1 DQT2.10 Microsoft Word Software Checkout Test Purpose.

The DQT2.10 verified that Microsoft Word for Windows (Version 1.1) software was resident and functional on each GMCC workstation.

3.2.10.2 DQT2.10 Microsoft Word Software Checkout Test Results.

The DQT2.10 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test sequence.

3.2.11 DQT2.11 Microsoft Windows Software Checkout Test.

3.2.11.1 DQT2.11 Microsoft Windows Software Checkout Test Purpose.

The DQT2.11 verified that Microsoft Windows (Version 3.0) software was resident and functional on each GMCC workstation. The DQT2.11 also verified that simultaneous operations could be performed using Windows on one GMCC workstation.

3.2.11.2 DQT2.11 Microsoft Windows Software Checkout Test Results.

The DQT2.11 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. Each GMCC workstation was capable of running three Tandem sessions two MMS/IMCS sessions and one Tandem Advanced Command Language (TACL) session simultaneously. One problem was observed:

a. A constant beep occurs at workstations that are running multiple IMCS sessions. This does not cause data loss or system degradation (PTR-10).

3.3 DQT3 FULL SERVICE SYSTEM STATE VERIFICATION.

The DQT3 verified full service system state requirements. The GMCC full service system state is defined as all workstations, processors, and communications lines being fully operational.

The DQT3 consisted of 12 test sequences: DQT3.1 Full Service System State Initialization, DQT3.2 MPS Software Compatibility, DQT3.3 Simultaneous Workstation Operations, DQT3.4 GMCC Operational Control, DQT3.5 GMCC Real-time Monitoring, DQT3.6 GMCC Certification, DQT3.7 Status and Alarm Handling, DQT3.8 Nonfacility Information Monitoring, DQT3.9 Full Service System State Response Time, DQT3.10 GMCC Reporting, DQT3.11 GMCC Loading Test, and DQT3.12 GMCC Network Reliability Test.

3.3.1 DQT3.1 Full Service System State Initialization Test.

3.3.1.1 DQT3.1 Full Service System State Initialization Test Purpose.

The DQT3.1 verified that GMCC equipment was configured and initialized as required to test the GMCC full service system state.

3.3.1.2 DQT3.1 Full Service System State Initialization Test Results.

The DQT3.1 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed. Powering up the GMCC network took approximately 10 minutes.

3.3.2 DQT3.2 MPS Software Compatibility Test.

3.3.2.1 DQT3.2 MPS Software Compatibility Test Purpose.

The DQT3.2 verified that the GMCC was capable of accessing MMS/IMCS software on the MPS by utilizing the Tandem PC6530 Terminal Emulation software package on the GMCC workstation.

3.3.2.2 DQT3.2 MPS Software Compatibility Test Results.

The requirements for this test sequence were verified during DQT3.3 through DQT3.12.

3.3.3 DQT3.3 Simultaneous Workstation Operation Test.

3.3.3.1 DQT3.3 Simultaneous Workstation Operation Test Purpose.

The DQT3.3 verified that all GMCC workstations could operate simultaneously. The MMS/IMCS operations were performed on each of the workstations at the same time. Operations included site monitoring, alarm acknowledgement, command issuance, and report generation.

3.3.3.2 DQT3.3 Simultaneous Workstation Operation Test Results.

The DQT3.3 was performed in accordance with the GMCC DQT&E test procedures. Testing revealed the following two printing problems:

- a. The IMCS reports could not be printed to the network printer (PTR-06).
- b. The MMS reports could only be printed on the network printer if the MMS session requesting the report was exited (PTR-07).

3.3.4 DQT3.4 GMCC Operational Control Test.

3.3.4.1 DQT3.4 GMCC Operational Control Test Purpose.

The DQT3.4 verified that the GMCC had operational control of its monitored facilities by sending commands, acknowledging alarms, and monitoring/unmonitoring specific sites and/or data points via MMS/IMCS.

3.3.4.2 DOT3.4 GMCC Operational Control Test Results.

The DOT3.4 was performed in accordance with the GMCC DQT&E test procedures. One problem was observed:

a. After a group of data points was selected for unmonitoring, IMCS indicated that not all the selected data points were unmonitored (PTR-08).

3.3.5 DOT3.5 GMCC Real-time Monitoring Test.

3.3.5.1 DOT3.5 GMCC Real-time Monitoring Test Purpose.

The DOT3.5 verified the capability of the GMCC to perform real-time monitoring of its monitored facilities via IMCS/MMS.

3.3.5.2 DOT3.5 GMCC Real-time Monitoring Test Results.

This test requires access to all facility logs, alarm and certification history data, and other facility information. This information was not available and so this test was deferred.

3.3.6 DOT3.6 GMCC Certification Test.

3.3.6.1 DOT3.6 GMCC Certification Test Purpose.

The DOT3.6 verified the capability of the GMCC to send RMS commands via MMS/IMCS to specific certification data points within an RMS.

3.3.6.2 DOT3.6 GMCC Certification Test Results.

The DOT3.6 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test.

3.3.7 DOT3.7 Status and Alarm Handling Test.

3.3.7.1 DOT3.7 Status and Alarm Handling Test Purpose.

The DOT3.7 verified the capability of the GMCC to process status and alarm messages via MMS/IMCS.

3.3.7.2 DOT3.7 Status and Alarm Handling Test Results.

The DOT3.7 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test.

3.3.8 DOT3.8 Non-Facility Information Monitoring Test.

3.3.8.1 DOT3.8 Non-Facility Information Monitoring Test Purpose.

The DOT3.8 verified the capability of the GMCC to monitor nonfacility information, such as weather data and air traffic restrictions, via MMS/IMCS.

3.3.8.2 DQT3.8 Non-Facility Information Monitoring Test Results.

Nonfacility information was not available for testing and so DQT3.8 was deferred.

3.3.9 DQT 3.9 Full Service System State Response Time Test.

3.3.9.1 DQT 3.9 Full Service System State Response Time Test Purpose.

The DQT3.9 verified that command execution and alarm presentation times were within the ranges specified in NAS-SS-1000.

3.3.9.2 DQT 3.9 Full Service System State Response Time Test Results.

The DQT3.9 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed. The GMCC workstation command execution times observed were under 3 seconds. The alarm presentation times were under 6 seconds.

3.3.10 DQT3.10 GMCC Reporting Test.

3.3.10.1 DQT3.10 GMCC Reporting Test Purpose.

The DQT3.10 verified GMCC reporting functions by utilizing MMS/IMCS functions.

3.3.10.2 DQT3.10 GMCC Reporting Test Results.

The DQT3.10 was performed in accordance with the GMCC DQT&E test procedures and was successfully completed on each GMCC workstation. No problems were observed during the conduct of this test.

3.3.11 DQT3.11 GMCC Loading Test.

3.3.11.1 DQT3.11 GMCC Loading Test Purpose.

The DQT3.11 verified that all GMCC workstations were capable of running independent MMS/IMCS sessions simultaneously. All workstations ran two IMCS sessions and one TACL session. The loading effects on the network were recorded.

3.3.11.2 DQT3.11 GMCC Loading Test Results.

Test results indicate, for the configuration shown in figure 2-3, that no significant system degradation occurred under the loaded conditions. The GMCC performed as expected.

3.3.12 DQT3.12 GMCC Network Reliability Test.

3.3.12.1 DQT3.12 GMCC Network Reliability Test Purpose.

The DQT3.12 verified that the GMCC network could reliably process alarms that were sent continuously from the monitored facilities. Two RMS simulators alternately sent streams of alarm and return to normal messages to the GMCC network.

3.3.12.2 DOT3.12 GMCC Network Reliability Test Results.

Test results indicate that no data loss was experienced when using a network configuration (figure 2-3). All alarm and corresponding return to normal messages (generated every 20 seconds) from the RMS simulators were received and displayed on each GMCC workstation.

4. CONCLUSIONS AND RECOMMENDATIONS.

4.1 CONCLUSIONS.

All phase I Design Qualification Test and Evaluation (DQT&E) requirements were either successfully completed prior to DQT&E testing or satisfactorily demonstrated during DQT&E testing. The phase I General National Airspace System (GNAS) Maintenance Control Center (GMCC) design is acceptable.

The phase II GMCC test configurations satisfactorily demonstrated the capability to interface with the Maintenance Processor Subsystem (MPS) via the StarLAN network. The GMCC workstation software applications functioned satisfactorily. A potential major problem is the lack of security on the StarLAN server that allows unauthorized access to the StarLAN network.

The FAA-E-2875 (GMCC Type A System Specification) phase II requirement states that up to four GMCCs may be connected to one MPS. This configuration was not available for testing. There are major impacts to the network configuration when expanding to the required four GMCCs. This configuration must be evaluated before design acceptance can be decided.

Failure mode testing was not formally conducted during DQT&E. Also, useability of GMCC software was not addressed. Both of these should be considered before a design acceptance decision is made.

Furthermore, some applications (i.e., status board, weather) required for phase II are not yet available. These applications must also be evaluated prior to design acceptance.

At the start of testing, the configuration of the GMCC network and Office Automation Technology and Services (OATS) commercial off-the-shelf (COTS) software was unclear. Any changes to the network and/or COTS software that were tested will necessitate additional DQT&E testing.

4.2 RECOMMENDATIONS.

ACN-250 submits the following recommendations:

- a. Conduct General National Airspace System (GNAS) Maintenance Control Center (GMCC) failure mode testing.
- b. Conduct a useability evaluation of GMCC software.
- c. Repeat some or all of Design Qualification Test and Evaluation (DQT&E) when a complete configuration (four GMCC Local Area Network (LANs) connected to a single Maintenance Processor Subsystem (MPS)) and when all software applications are available.
- d. Conduct all recommended testing (a through c) before a design qualification decision is made.

APPENDIX A

TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
FAA-XX-XXXX GMCC A-Level Specification	3.2.1 - Performance Characteristics	a. Transmit/receive data to/from designated facilities and personnel	D	DQT3.4	Operational Control	
		b. Input, process, and output data in accordance with 3.2.1.4 and 3.2.1.5	D	DQT3.4	Operational Control	
		c. Operates in Full Service System State within stated response times	D	DQT3.1, DQT3.9	System Init, System Response Time	1
		d. Operates in Reduced Service System State (provides essential services)	X			
		e. Operates in Reconfigured Service System State (accepts/transfers operational functions from/to another MCC when required)	X			2

1 - Reduced Service System State will be verified during subsequent GMCC Testing.

2 - Reconfigured Service System State will be verified during subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
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Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1 - Full Service System State	f. Provides capability (i.e. supports all operator actions required to change system states) to coordinate and control the transfer of operational functions to any other GMCC regardless of system state	X			1
		g. Operation of GMCC equipment shall not be degraded by, nor degrade operation of any other GMCC regardless of system state				
		a. All workstations, displays, processors, and communications lines are fully operational	D	DQT3.1	System Init	
		b. Possesses operational control and responsibility over facilities in area of jurisdiction	D	DQT3.3, DQT3.4	Simultaneous WS Operation, Operational Control	

- 1 - Not available for DQT&E testing. This will be tested during subsequent GMCC Testing.
2 - Testing did not include status board, weather, or graphic displays.
3 - Only tested application software.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.1 - Realtime Monitoring Function	c. Upon systems restart, GMCC shall initiate operations in the Full Service System State	D	DQT3.1	System Init	1
		a. Provides capability for around-the-clock realtime determination/display of facility/equipment performance characteristics including status data at the facility, system, subsystem, equipment and service levels	X			
		b. Provide access to automated comparison of actual performance parameter values to pre-established standards tolerances and thresholds	X			2
		c. Provide capability for realtime certification of facility performance	D	DQT3.6	Certification	3

- 1 - GMCC Performance Data is not available
2 - Performance Parameter values are not available
3 - Certification Data is not available. However, DQT&E will verify that the GMCC has access to RMS Certification Commands.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.1.1 - Facility Monitoring Subfunction	a. Provide all current RMS facility performance data via MPS	X			1
		b. Provide access to appropriate contacts to receive current status data for non-remote-controlled facilities	X			2
		c. Provide access to all monitored facility logs, alarm and certification history data, waivers, key performance and/or certification parameter trends, and other available non-realtime supporting performance documentation	D	DQT3.3, DQT3.6, DQT3.10	Simultaneous WS Operation, Certification Reporting	3
		d. Provide access to capability to disable/enable of status changes	D	DQT3.7	Status/Alarm Handling	

- 1 - GMCC Performance data is unavailable.
2 - This requirement has been deferred.
3 - Waivers, key performance and certification parameter trends have not been implemented.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Referer-e Document	Paragraph Number and Title	Requirement Description	Verifi- cation Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.1.2 - Facility Status Display Subfunction	a. Provide displays of current status of all facilities within jurisdiction	D	DQT3.3	Simultaneous WS Operation	1
		b. Provide capability to simultaneously present multiple categories of data	D	DQT2.11	Windows	
		c. Significant data easily distinguished	D	DQT3.3	Simultaneous WS Operation	
		d. Provides realtime status information on request at following level of detail: 1) Current operational relationships among facilities (including status of communications links)	X			
		2) Current facility operational configuration	D	DQT3.3, DQT3.4	Simultaneous WS Operation, Operational Control	
		3) Facility operation including all current PMS data (via MPS)	D	DQT3.3	Simultaneous WS Operation	

1 - This requirement has been deferred.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTHM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX - GMCC A-Level Specification	3.2.1.1.1.3 - Facility Alarm Subfunction	e. Displays organized to enable "zoom in" from status overview	D	DQT2.11	Windows	1
		a. Provide capability to set alert thresholds	X			2
		b. Provide priority-conditioned notification of all facility alarms via aural/visual presentations	D	DQT3.7	Status/Alarm Handling	
		c. Provide a means to verify/acknowledge assigned facility alarms/"return to normal" messages	D	DQT3.7	Status/Alarm Handling	3
FAA-XX-XXXX - GMCC A-Level Specification	3.2.1.1.1.4 - Non-Facility Information Monitoring Sub-function	Provide current non-facility-related information (e.g., weather, NOTAMS, etc.)	X			

- 1 - Verified through the commercial-off-the-shelf software package MS-Windows.
- 2 - Alert thresholds can only be set at the Local Terminal.
- 3 - Non-facility information monitoring has not been implemented.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.1.5 - Facility Log Entry Subfunction	Provide capability to enter statements into monitored facility log	D	DQT3.10	Reporting	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.1.6 - Security Access Subfunction	Provide access to relevant security information	D	DQT3.3	Simultaneous WS Operation	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2 - Non-Realtime Monitoring Function	Retrieve, display, and analyze performance data from automated systems and field personnel	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2.1 - Facility Performance Checklist Subfunction	Provide access to checklist of all key performance/certification parameters (with associated tolerance/threshold values) for any selected facility within jurisdiction	X			2
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2.2 - Facility History And Trends Subfunction	a. Provide access to specified facility logs, alarm/certification histories, waivers, and other non-realtime facility performance data	X			1

1 - Performance data for GMCC is not available.

2 - GMCC checklists have not been implemented. This requirement has been deferred to subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2.3 - Facility Verification Subfunction	b. Provide access to information regarding historical trends in key performance/certification parameters of selected monitored facilities	X			1
		a. Provide access to information regarding performance of routine scheduled maintenance at specified monitored facilities	X			1
		b. Provide access to information regarding certification of specified monitored facilities	X			1

1 - Not currently implemented. This requirement has been deferred to subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2.4 - Facility Scheduling Checklist Subfunction	a. Provide access to checklist of all facilities in jurisdiction requiring shutdown for performance of routine scheduled maintenance within specified time interval	X			2
		b. Provide access to checklist of all facilities in jurisdiction requiring certification within specified time interval	X			1
		c. Provide access to checklist of all facilities in jurisdiction for which certifications are overdue or for which there are a pre-defined significant levels of non-performance for PM actions supporting certification	X			1

1 - GMCC checklists have not been implemented. This requirement has been deferred to subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2.5 - Logistics Management Information Subfunction	Provide access to general information concerning logistics within jurisdiction	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.2.6 - Field Organization Points of Contact Subfunction	Provide access to appropriate points of contact within AF/AT field organizations and telephone numbers	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.3 - Facility Control Function	Provide capability to alter status, configuration, mode or performance of monitored facility	D	DQT3.4	Operational Control	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.3.1 - Facility Control Message Transmission Subfunction	Provide capability to transmit control messages to monitored facilities	D	DQT3.4	Operational Control	

1 - This requirement has been deferred.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.3.2 - Command Sequence Checklist Subfunction	a. Provide access to menus/checklists which detail specific commands/command sequences to use for performance of each available remote maintenance control action for each facility in jurisdiction	X			1
		b. Provide capability to bypass menus/checklists				
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.3.3 - Emergency and Backup Test Subfunction	Provide means to test operational readiness of emergency backup/safety features of monitored facilities	X			2
		a. Provide positive feedback that indicates control actions produced desired results				
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.3.4 - Positive Feedback Subfunction	b. Provide positive feedback for operator errors	D	DQT3.4	Operational Control	

- 1 - GMCC checklists have not been implemented. This requirement has been deferred to subsequent GMCC Testing.
2 - This requirement will be verified during System Level Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR TM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.4 - Communication And Coordination Function	a. Receive/disseminate facility performance/maintenance data from/to AF field elements, users, and third parties	X			1
		b. Provide voice/data communication links to all monitored facilities within jurisdiction and with other MCCs	X			1
		c. Provide backup communications to serve area of jurisdiction	X			1
		d. Provide the capability to enable authorized non-routine users to access data through normal security procedures	X			2
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.4.1 - Internal (FAA) Communications Links Subfunction	a. Provide access to two-way voice and data communications (internal to FAA) at any operator position	X			1

1 - Voice/data communication links will be verified during site level testing.

2 - This requirement will be verified during OT&E/I/ST&E testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		b. Provide hardware/software to establish and support non-GMCC voice/data communications through Government-furnished communications equipment at any operator position	D			1
		c. Provide access to voice/data communications links to Work Center responsible for maintenance of a given failed facility and receive technical reports from the field via these links	X			2
		d. Provide access to voice/data communications links to an on-site systems specialist at each facility in area of jurisdiction	X			2

- 1 - DQT&E will verify a phone line and/or modem is available at the testing site.
2 - Voice/data communication links will be verified during site level testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verifi- cation Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		e. Provide access to a voice/ data communications link to a designated single AT point of contact	X			1
		f. Provide access to voice/data communications links to other GMCC's to facilitate transfer of maintenance and control responsibilities related to facility maintenance and re- configuration activity	X			1
		g. Provide access to a dedicated, protected (level of protection TBD) "hot- line" voice and/or data link to NMCC	X			1

1 - Voice/data communication links will be verified during site level testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		h. Provide access to voice/data communications links to the FAA Depot to facilitate field requests and deliveries of P1 (highest priority) spare parts required for facility restoration	X			1
		i. Provide access to voice/data communications links to AF/AT management/field supervisory personnel, including home and enroute callback access	X			1
		j. Provide access to voice/data communications links to NFSSs	X			1
		k. Provide access to voice/data communications links to designated ATC personnel	X			1

1 - Voice/data communication links will be verified during site level testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification		1. Provide access to voice communications links to higher-level FAA personnel (at other Sector and Regional Offices) on the notification lists described in section 3.2.1.1.4.4.	X			1
	3.2.1.1.4.2 - External (Non-FAA) Communications Links Subfunction	a. Provide capability to exchange two-way voice/data communications (external to FAA organizations) at any operator position	X			1
		b. Provide hardware/software to establish and support non-GMCC voice/data communications through Government-furnished communications capabilities at all operator positions	D			2

- 1 - Voice/data communication links will be verified during site level testing.
2 - DQT&E will verify a phone line and/or modem is available at the testing site.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR™)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		c. Provide capability to communicate by voice with AT and AF supervisory personnel and systems specialists either at their homes after normal working hours, in vehicles en route, or in monitored facilities 1) Display names, addresses, certifications, and telephone numbers of these personnel along with priorities of contact for certain operational situations	X			1
		d. Provide access to voice communications links to appropriate military contacts for coordination of restoration actions at joint use facilities	X			1

1 - Voice communication links will be verified during site level testing.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.4.3 - Coordination Support Subfunction	e. Provide access to voice communications links to TELCO, power companies, or other utilities responsible for provision of prime power or communications links to remote facilities	X			1
		f. Provide access to voice communications links to all local, state, and Federal organizations that respond to emergencies involving FAA facilities	X			1
		g. Provide access to voice communications links to airport authorities and other designated third parties	X			1
		a. Provide access to graphic map displays for reference purposes to be made available at the GMCC-WS	X			2

- 1 - Voice communication links will be verified during site level testing.
2 - Graphic map displays will be verified during GMCC system level testing.

APPENDIX A: GMCC DQT&E²
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		b. Provide access to automatically-updated graphic status displays of all facilities within jurisdiction area as well as those facilities monitored by other GMCCs and present on any display	X			1
		c. Provide access to displays of scheduled flight inspections for facilities within jurisdictional area, including date/time and facility involved.	X			1
		d. Provide access to displays of current locations and IDs of AF maintenance personnel currently performing maintenance actions	X			1

1 - This requirement has been deferred.

**APPENDIX A: CMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference CMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX CMCC A-Level Specification	3.2.1.1.4.4 - Actions And Modifications Checklists Subfunction	a. Provide access to a check-list of available remote control or reconfiguration actions to pursue under various facility alarm conditions for each facility in jurisdictional area	X			1
		b. Provide access to checklists of AF and other personnel to be notified and actions to be taken under various aircraft incident circumstances	X			1
		c. Provide access to a check-list of facility shutdowns that are scheduled within a specified interval, together with the time of shutdown, expected duration and indications as to whether or not AT approval is required	X			1

1 - CMCC checklists have not been implemented. This requirement has been deferred to subsequent CMCC testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.4.5 - Aircraft Incident Electronic Archive Subfunction	d. Provide access to a check-list of required coordination activities for each facility in jurisdiction	X			1
		e. Provide access to check-lists of emergency actions as required by FAA Orders and Directives for upward and downward notification within the organization	X			1
		a. Provide access to the means to electronically archive all relevant facility logs, performance and control data	D	DQT3.3	Simultaneous WS Operation	
		b. Provide capability to generate hard copies of all documents archived in this manner	D	DQT3.3	Simultaneous WS Operation	

1 - GMCC checklists have not been implemented. This requirement has been deferred to subsequent GMCC testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.4.6 - Flight Inspection Reports Subfunction	Provide access to flight inspection reports for all facilities within jurisdiction	X			1
	3.2.1.1.4.7 - NOTAM Information Access Subfunction	Provide access to NOTAM data, RENOTs, and GENOTs concerning facility operation within own jurisdiction of adjacent GMCCs				
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.5 - Reporting Function	GMCC shall initiate and maintain an accurate, verifiable, and legally valid record of all actions taken by operators with respect to facility performance or maintenance management within jurisdiction	D	DQT3.3	Simultaneous WS Operation	2
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.5.1 - GMCC Log Subfunction	Provide means to enter data into electronic storage files resident on the MPS	D	DQT3.10	Reporting	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.5.2 - Monitored Facility Log Subfunction	Provide capability to make pertinent entries into facility logs for all monitored facilities within jurisdiction	D	DQT3.10	Reporting	

1 - This requirement has not been implemented.

2 - Operator actions will be recorded. GMCC does not yet maintain actions with respect to facility performance.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.1.5.3 - Scratch Pad Subfunction	Provide access to erasable non-volatile "scratch pad" electronic data file to store information	D	DQT3.9	System Response Time	1
	3.2.1.1.6 - Training Operations	a. Supports training operations in the Full Service System State	X			1
		b. Provides an operator-selectable capability to dedicate one or more operator positions to training operations. During this time, all other workstations shall continue to operate normally	X			1
		c. Supports initiation of training operations on a position-by-position basis	X			1

1 - Training operations have not been implemented.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		d. All WSs dedicated to training shall be unable to control or modify any operational database or checklists, or any facility; Otherwise, each WS dedicated to training operations shall have full control of all GMCC functions	X			1

1 - Training operations have not been implemented.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
		<p>e. When an operator position is dedicated to training operations, GMCC shall support either of the following types of operation:</p> <p>1) GMCC shall simulate a training exercise at the operator position</p> <p>A. During the simulation, GMCC shall simulate normal operation and use of all system functions at the operator position</p> <p>B. Actual facility control, modification of any operational database or checklist, and outside communications shall be disabled</p>	X			1

1 - Training operations have not been implemented.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.2 - Reduced Service System State	2) GMCC shall support the normal operation of the operator position except that actual facility control and modification of any operational database or checklist is disabled.	X			1
		Performs all of the functions of the Full Service System State operating under the following exceptions:	X			2
		a. At least one operator workstation is fully operational				
		b. Either voice or radio communications are fully operational	X			2
		c. Both the FSD and Weather Data functional areas are fully operational	X			2

1 - Training operations have not been implemented.

2 - Reduced Service System State will be verified during subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.3 - Reconfigured System State	d. The system is meeting all Reduced Service response time requirements of section 3.2.1.5	X			1
		e. The GMCC has operational control and responsibility over the facilities in its area of jurisdiction (only)	X			1
		a. All hardware and software functions are operational	X			2
		b. All workstations, displays, processors, and communications lines are operational	X			2
		c. Meets all response time requirements of section 3.2.1.5	X			2
		d. Operates in either the reduced or augmented mode of operation	X			2

1 - Reduced Service System State will be verified during subsequent GMCC Testing.

2 - Reconfigured System State will be verified during subsequent GMCC Testing.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR_{TM})

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.3.1 - Reduced Operations Mode	e. Is capable of performing all functions for the Full Service System State	X			1
		Performs all the functions specified for the Full Service System State except that GMCC shall not allow the operators to alter the status of any facility in its jurisdiction; all operational responsibilities transferred to another GMCC or Area Control Facility MCC (AMCC) serviced by the same MPS	X			2
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.3.2 - Augmented Operations Mode	a. Takes operational responsibility for another GMCC	X			3

- 1 - Reconfigured System State will be verified during subsequent GMCC Testing.
- 2 - Reduced Operations Mode will be verified during subsequent GMCC Testing.
- 3 - Augmented Operations Mode will be verified during subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR TM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.4 Design Limits	b. Performs all of the functions specified for the Full Service System State and meet all response time requirements for its area of jurisdiction and the jurisdiction of the GMCC for which it has taken responsibilities	X			1
		c. Provides capability to perform twice the maximum workload requirements specified for a single GMCC in the Full Service System State	X			1
		Sufficient number of communications links and sufficient communications bandwidth available to support operations in Augmented Mode of Reconfigured System State	X			1

1 - Cannot be verified during DQT&E.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR TM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.5.1.1.1 - Data Collection Requirements	Collects and presents key performance parameter, diagnostic performance parameter or facility data for a single report from MPS in a mean time of one (1) second after receipt at the GMCC input buffer	X			1
	3.2.1.5.1.1.2 - Alarm And Alert Requirements	a. Displays alarms, alerts, and state changes from all designated subsystems within a mean time of 1.0 second and a maximum time of 2.0 seconds b. Prepares an alarm or an alert acknowledgement within a mean time of 1.0 second and a maximum time of 2.0 seconds	D	DQT3.9	System Response Time	
FAA-XX-XXXX GMCC A-Level Specification			D	DQT3.9	System Response Time	

1 - Performance parameter data is not available for the GMCC.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.1.5.1.3 - Communications Requirements	c. Deactivates an alarm or an alert indication within a mean time of 1.0 second and a maximum time of 2.0 seconds	D	DQT3.9	System Response Time	1
	3.2.1.5.2 - Reduced Service Response Time Requirements	Accepts data from and transfers data to the MPS at a rate of at least 19,200 bps. In the Reduced Service System State, GMCC shall meet the same response time requirements as in Full Service System State	X			2
	3.2.1.5.3 - Reconfigured Response Time Requirements	In the Reconfigured System State, GMCC shall meet the same response time requirements as in the Full Service System State	X			3
FAA-XX-XXXX GMCC A-Level Specification	3.2.2 - System Capability Relationships	a. In the Full Service System State, GMCC shall perform all functions assigned to this system state	D	DQT3	ALL	

- 1 - This requirement will be verified during subsequent GMCC Testing.
- 2 - Reduced Service System State will be verified during subsequent GMCC Testing.
- 3 - Reconfigured System State will be verified during subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.1 MPS Interface	b. In the Reconfigured System State, GMCC shall perform all functions of this specification in both the Reduced Operations and Augmented Operations modes	X			1
		c. In the Reduced Service System State, GMCC shall perform all functions of this specification except as limited by section 3.2.1.2	X			2
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.2 MMS Interface	Provides an interface with MPS hardware	D	DQT3.3	Simultaneous WS Operation	
		a. Provides an interface with MMS software	D	DQT3.3	Simultaneous WS Operation	
		b. Each operator workstation capable of conducting an independent MMS session	D	DQT3.3	Simultaneous WS Operation	

- 1 - Reconfigured System State will be verified during subsequent GMCC Testing.
2 - Reduced Service System State will be verified during subsequent GMCC Testing.

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTHM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
		<p>c. Exchanges the following types of data:</p> <p>1) Checklists of facility parameters, trend values, facility logs, scheduled maintenance, alarm and certification histories, waivers, procedures for maintenance verification, and points of contact within user and maintenance organizations</p> <p>2) Facility logs, alarm histories, and other non-realtime facility performance data as required to verify actions in the realtime environment, and for entry of certification statements in the monitored facility log</p>	D	DQT3.3, DQT3.6	Simultaneous WS Operation Certification	

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.3 - (1)MCS Interface	3) Command checklists or menus for performance of remote control actions	X			1
		4) Facility performance trends, locations of AF systems specialists currently performing maintenance actions, checklists of recommended facility restoration actions, incident or emergency procedures, and notification or callback lists	X			1
		5) Access security control for MMS and (1)MCS	D	DQT3.3	Simultaneous WS Operation	
		6) Selected MMS logs and reports for printout at the GMCC worksite	D	DQT3.3	Simultaneous WS Operation	
		a. Provides an interface with (1)MCS software	D	DQT3	ALL	

1 - GMCC checklists have not been implemented. This requirement has been deferred to subsequent GMCC Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
		b. Each operator workstation shall be capable of conducting an independent (I)MCS session	D	DQT3.3	Simultaneous WS Operation	
		c. Access to (I)MCS shall be through the MMS interface which provides for system security, control, and authentication	D	DQT3.3	Simultaneous WS Operation	
		d. The GMCC interface with (I)MCS shall exchange the following types of data: 1) Realtime data on facility performance and status. The Remote Maintenance Monitoring System (RMMS), of which (I)MCS is a component, will be the source of all facility parameter, notification and alarm data, and will be used for generation of all internal self-verification checks	D	DQT3.4, DQT3.7	Operational Control Status/Alarm Handling	

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.4 - Weather Data Systems Interface	2) Transmission of control commands to monitored facilities and reception of realtime data concerning facility status from monitored sites, and monitoring and/or emergency/backup system integrity checks	D	DQT3.4	Operational Control	
		3) Display data of facility operational status and alarms	D	DQT3.4	Operational Control	
		4) Selected (1)MCS logs and reports for hard copy printout	D	DQT3.3	Simultaneous WS Operation	
		a. Provides an interface Weather Data Systems (WDS)	X			1
		b. Presentation of weather data coincides with jurisdiction	X			1
		c. Receives weather data for realtime retrieval and display	X			1

1 - The Weather Data Systems Interface is unavailable but will be verified during GMCC Integration Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.5 - Consolidated NOTAM System Interface	Provides an interface with Consolidated NOTAM System, Leased Service A and B (or functionally equivalent replacement), and NADIN and exchanges the following types of data:	X			1
		a. Current NOTAM data including reports concerning facilities within the GMCC area of jurisdiction and other GMCCs	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.6 - National Flight Inspection Reporting System (NFIRS) Interface	b. GENOTs and RENOTs	X			1
		Provides an interface with NFIRS and exchanges the following types of data: a. Flight inspection reports b. Schedule of flight checks	X			2

- 1 - The consolidated NOTAM System Interface is unavailable but will be verified during GMCC Integration Testing.
2 - The NFIRS interface is unavailable but will be verified during GMCC Integration Testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTRM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.2.3.7 - Telephone Communications Network Interface	Provides an interface with local telephone utility for voice communications	X			1
	3.2.3.8 - Two-Way Radio Communications Network Access	a. Provides access to two-way radio communications b. Includes voice links with systems specialists in remote locations or vehicles c. This Government-furnished equipment shall be housed in the GMCC workstation	X			2
FAA-XX-XXXX GMCC A-Level Specification	3.2.4 - Physical Characteristics	Capable of operating in a standard office environment and meets all appropriate requirements for protective coatings, weight and dimensional limits, transportation and storage, security, durability, safety, vulnerability, color, and device characteristics	I	DQT1		

- 1 - Voice communications will be verified during site level testing.
2 - Radio communications will be verified during site level testing.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
FAA-XX-XXXX GMCC A-Level Specification	3.2.4.1 - Protective Coatings	Newly-designed equipment finished in accordance with the applicable provisions of FAA-STD-001	I	DQT1		
FAA-XX-XXXX GMCC A-Level Specification	3.2.5.1 - Reliability	Meets reliability limit of 2,573 hours Mean Time Between Failures	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.2.5.2 - Maintainability	Meets maintainability limit of 0.5 hours Mean Time To Repair	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.2.5.3 - Availability	Meets availability requirement of .9998057	X			1
FAA-XX-XXXX GMCC A-Level Specification	3.3.1 - System Security	a. Designed and constructed to provide protection against unauthorized system access b. Provides protection against unauthorized modification to any system element	D	DQT3.4	Operational Control	
			D	DQT3.4	Operational Control	

1 - This requirement has been deferred.

**APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTHM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification	3.4 - Documentation	c. Provides security against loss of system services by the inadvertent or unauthorized action of other system users	D	DQT3.4	Operational Control	
		d. Provides protection against unauthorized modification or bypass of any system security logic	D	DQT3.4	Operational Control	
		e. Alerts personnel and identifies source of attempts to defeat system security features	D	DQT3.4	Operational Control	
		a. Product Specification: GMCC design shall be documented in product specifications in accordance with FAA-STD-005D	I			

APPENDIX A: GMCC DQT&E
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR TM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
FAA-XX-XXXX GMCC A-Level Specification		b. Interface Control Documents: All GMCC Interfaces shall be documented in Interface Control Documents (ICDs) in accordance with applicable paragraphs of FAA-STD-025	I			
		c. Configuration Management Plan: The CM Plan shall be prepared in FAA-D-249d format	I			
	3.5 - Logistics	GMCC requirements for ILS, logistics support analysis (LSA), and hardware and software maintenance shall be satisfied in accordance with FAA Order 1800.58	I			
FAA-XX-XXXX GMCC A-Level Specification	3.6 - Personnel and Training	The GMCC training program shall be prepared and conducted in accordance with FAA-STD-028A	I			

APPENDIX A: NAS-SS-1000 VOLUME I
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
NAS-SS-1000 VOLUME I	3.2.1.1.9.1.a	Continually monitor subsystem performance to obtain the data needed by specialists for maintenance and operations support.	D	DQT3	ALL	
NAS-SS-1000 VOLUME I	3.2.1.1.9.1.b	Provide the status of subsystem to specialists and generate an alarm upon the deviation of designated parameters from prescribed limits.	D	DQT3.7	Status/Alarm Handling	
NAS-SS-1000 VOLUME I	3.2.1.1.9.1.f	Provide for the organization and processing of the information necessary for the management of maintenance resources and the preparation of NAS status reports.	D	DQT3.3	Simultaneous WS Operation	
NAS-SS-1000 VOLUME I	3.2.1.1.9.1.g	Provide the specialist access to the monitoring, control, and data management capabilities.	D	DQT3	ALL	

**APPENDIX A: NAS-SS-1000 VOLUME I
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
NAS-SS-1000 VOLUME I	3.2.1.2.9.a	Provide the capability to continually monitor the status, alarms/alerts and performance data of selected subsystems.	D	DQT3	ALL	
NAS-SS-1000 VOLUME I	3.2.1.2.9.b	Provide the capability to detect and present alarms and state changes from selected subsystems within an average time of 10 seconds and a maximum time (99th percentile) of 60 seconds.	T	DQT3.9	System Response Time	
NAS-SS-1000 VOLUME I	3.2.1.2.9.c	Provide the capability to execute control commands within an average time of 5 seconds and a maximum time (99th percentile) of 15 seconds.	T	DQT3.4	Operational Control	
NAS-SS-1000 VOLUME I	3.2.1.2.9.e	Provide an acknowledgement to a specialist of a subsystem's receipt of a valid test command within an average time of 15 seconds and a maximum time (99th percentile) of 75 seconds.	T	DQT3.9	System Response Time	

**APPENDIX A: NAS-SS-1000 VOLUME I/VOLUME V
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
NAS-SS-1000 VOLUME I	3.4	Documentation for the NAS system, elements, subsystems, including interfaces, shall be prepared, processed, and controlled in accordance with applicable standards and specifications.	I			
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.1.a	Receive and distribute status and control data of NAS sub-systems.	D	DQT3	ALL	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.1.b	Provide validation of status data and accomplishment of control functions.	D	DQT3.4	Operational Control	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.1.c	Provide analysis of data for situation appraisal, decision analysis and failure effects.	D	DQT3.4	Operational Control	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.1.d	Control input/output processing of data communications for man/machine interfaces.	A			
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.2.a	Provide input/output functions for control/display.	D	DQT3.4	Operational Control	

**APPENDIX A: NAS-SS-1000 VOLUME V
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)**

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.2.b	Display of color graphics with windowing and zoom features.	D	DQT2.11	Windows	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.2.c	Configuration of NAS facilities/services within a predetermined area.	D			
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.3.a	Review, control, and verify subsystem data, performance information and certification parameters.	D	DQT3.6	Certification	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.3.b	Provide information available at various predetermined levels of specificity.	A			
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.4	Provide status of NAS sub-systems, equipment, available resources, and available communications connectivities.	D	DQT3	ALL	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.5	Provide configuration information required for performance of maintenance activities.	D	DQT3	ALL	

APPENDIX A: NAS-SS-1000 VOLUME V
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTRM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference CMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.6	Provide the capability to prioritize status and alarm information, and provide visual/aural indications for status/alarm data.	D	DQT3.7	Status/Alarm Handling	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.7	Provide alarm/alert indications in sufficient detail to allow determination of effects on system integrity.	D	DQT3.7	Status/Alarm Handling	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.8	Provide the capability to disable the reporting of an alarm or alert.	D	DQT3.4, DQT3.9	Operational Control, System Response Time Status/Alarm Handling	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.9	Provide the capability to deactivate alarm/alert indications.	D	DQT3.7	Status/Alarm Handling	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.10	Provide the capability to verify and acknowledge alarms/alerts.	D	DQT3.7	Status/Alarm Handling	

APPENDIX A: NAS-SS-1000 VOLUME V
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.15	Provide the capability to initiate diagnostics or certification tests and report the results of these tests to the specialists.	D	DQT3.6	Certification	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.16	Provide access to all management information function capabilities of the RMNS.	D	DQT3.6	Certification	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.18	Provide the capability for storage and retrieval of predetermined checklists.	X			1
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.19	Provide utilization menus and checklists for input/output alternatives to the specialist.	X			1
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.20	Provide high resolution color display with graphics capabilities.	D	DQT2	ALL	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.21	Provide access to an erasable electronic scratchpad.	D			

1 - Checklists have not yet been implemented.

APPENDIX A: NAS-SS-1000 VOLUME V
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
NAS-SS-1000 VOLUME V	3.2.1.1.8.1.22	Provide the capability to request access to monitoring, control and data management functions as authorized by administrative directive.	D	DQT3.4	Operational Control	
NAS-SS-1000 VOLUME V	3.2.1.1.8.3	Interface functionally and physically with MPS.	L	DQT3	ALL	
NAS-SS-1000 VOLUME V	3.2.7.1	Automatic data processing of NAS subsystems shall be protected.	D	DQT3.4	Operational Control	
NAS-SS-1000 VOLUME V	3.4	Documentation for the NAS system, elements, sub-elements, and subsystems, including interfaces, shall be prepared, processed, and controlled in accordance with applicable standards and specifications.	I			
NAS-SS-1000 VOLUME V	3.5	NAS subsystem equipment shall be provided spare parts and consumables necessary for maintaining subsystem readiness and subsystem component repair.	I			

APPENDIX A: NAS-MD-794
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVR TM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
NAS-MD-794	1.1	Provide clear, concise displays of the current status of all facilities.	D	DQT3	ALL	
NAS-MD-794	1.2	Provide access to all monitored facility logs, alarm and certification history data, waivers, key performance and/or certification parameter trends.	D	DQT3.3, DQT3.6, DQT3.10	Simultaneous WS Operation Certification Reporting	
NAS-MD-794	1.3	Provide the capability of selectively disabling or enabling notification of status changes as they occur.	D	DQT3.7	Status/Alarm Handling	
NAS-MD-794	1.5	Provide priority-conditioned notification of all facility alarms.	D	DQT3.7	Status/Alarm Handling	
NAS-MD-794	1.6	Provide a means to rapidly verify and acknowledge assigned facility alarms and/or "return to normal" messages.	D	DQT3.7	Status/Alarm Handling	
NAS-MD-794	1.7	Provide sufficient current information regarding monitored facility performance.	D	DQT3.7	Status/Alarm Handling	

APPENDIX A: NAS-MD-794
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTM)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		
				Test ID	Test Name	Notes
NAS-MD-794	1.10	Provide the capability to enter pertinent maintenance as well as certification statements into a monitored facility log.	D	DQT3.10	Reporting	
	1.11	Provide access to relevant security information in order to verify whether the MCC specialist attempting to perform facility certification trans-actions possesses the appropriate certification credentials.	D	DQT3.3	Simultaneous WS Operation	
NAS-MD-794	2.2	Provide information regarding historical trends in key performance and/or certification parameters of specified monitored facilities.	D	DQT3.6	Certification	
NAS-MD-794	2.4	Provide information regarding the performance of routine scheduled maintenance at specified monitored facilities.	D	DQT3.6	Certification	

APPENDIX A: NAS-MD-794
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVTMT)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
NAS-MD-794	2.5	Provide information regarding the certification of specified monitored facilities.	D	DQT3.6	Certification	
NAS-MD-794	2.6	Provide a computer-generated checklist of all facilities which will require shutdown for performance of routine scheduled maintenance.	X			1
NAS-MD-794	2.7	Provide a computer-generated checklist of all facilities for which certification will be required within a specified time interval.	X			1
NAS-MD-794	2.8	Provide a computer-generated checklist of all facilities within its area of jurisdiction for which certifications are overdue.	X			1
NAS-MD-794	2.9	Provide a computer-generated list of appropriate points of contact within the AF and AT field organizations.	X			1

1 - Checklists have not yet been implemented.

APPENDIX A: NAS-MD-794
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference GMCC DQT&E Test Procedures		Notes
				Test ID	Test Name	
NAS-MD-794	2.11	Provide access to computer generated information concerning maintenance logistics within the MCC area of jurisdiction.	X			1
NAS-MD-794	3.1	Provide the capability to transmit various types of control messages to monitored facilities.	D	DQT3.4	Operational Control	2
NAS-MD-794	3.2	Provide computer-generated menus or checklists for each facility.	X			
NAS-MD-794	3.4	Provide positive feedback that control actions taken have indeed produced desired results.	D	DQT3.4	Operational Control	
NAS-MD-794	4.2.6	Provide the means to electronically archive all relevant facility logs, performance and control data for later use in an accident/incident investigation.	D	DQT3.3	Simultaneous WS Operation	

1 - This requirement has been deferred.

2 - Checklists have not yet been implemented.

APPENDIX A: NAS-MD-794
TEST VERIFICATION REQUIREMENTS TRACEABILITY MATRIX (TVRTH)

Reference Document	Paragraph Number and Title	Requirement Description	Verification Method	Cross Reference CMCC DQT&E Test Procedures		
				Test ID	Test Name	
NAS-MD-794	4.4.1	Provide the capability to provide status display of all facilities.	D	DQT3.4	Operational Control	1
NAS-MD-794	5.1	Provide the means to enter data as appropriate into electronic storage files designated the "MCC log".	X			
NAS-MD-794	5.2	Provide the capability to make pertinent entries into facility logs for all monitored facilities.	D	DQT3.10	Reporting	1
NAS-MD-794	5.3	Provide an erasable "scratch pad" electronic data file.	X			

1 - Not currently implemented.

APPENDIX B

PHASE II GMCC CONFIGURATION
(AT&T FEDERAL SYSTEMS DOCUMENT)

GMCC Integration Document

FAA Technical Center

April 1991

Prepared by: AT&T Federal Systems

Date: April 1991

Version: Draft 1.0

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1. Introduction

This document was produced to detail the procedures carried out in setting up the General Maintenance Control Center (GMCC) system. The document includes hardware and software configuration procedures and modifications, application procedures, system diagrams and a complete CLIN listing. The project was carried out over a six week period from March 18th to April 26th 1991, at the FAA Technical Center near Atlantic City. Assistance during the project was provided by the following individuals:

Richard Van Suetentael	(FAA)
Dennis Steelman	(FAA)
Bill Gibbons	(Tandem)
Tom Miller	(Tandem)
Phillip Hoang	(FAA)
Samer Salty	(Martin Marietta)
Julie Riches	(CTA/ACN-250)
Mike Jones	(CTA/ACN-250)
Craig Stewart	(CTA/ACN-250)

2. System Architecture

2.1 System Overview

Two system configurations were set up and tested during the project. The first configuration connected the OATS network directly to the MLAD computer through the NHU (Network Hub Unit). The second configuration included the Brouter hardware which provided a bridge between the MLAD and the OATS network. System diagrams for both configurations are provided in appendices A and B.

2.2 System Components

2.2.1 OATS Workstation

- 80386 25 Mhz processor / 4 MB RAM
- 84 MB SCSI hard disk
- 3.5"/1.44 MB and 5.25"/1.2 MB floppy disk drives
- VGA Color Monitor CRT 329D
- 10 MB StarLAN NAU card
- 305 Keyboard
- Microsoft Mouse

2.2.2 OATS Server

- 80386 25 Mhz processor / 8 MB RAM
- 300 MB SCSI hard disk
- 3.5"/1.44 MB and 5.25"/1.2 MB floppy disk drives
- VGA Color Monitor CRT 329D
- 10 MB StarLAN NAU card
- 305 Keyboard
- Hi-Cap Internal Tape Cartridge
- Microsoft Mouse

2.2.3 MLAD Unit

- Tandem 80286
- 20 MB SCSI hard disk
- 5.25"/1.2 MB floppy disk drive
- MDA Monochrome Monitor
- 10 MB StarLAN NAU card
- 3-COM adapter card
- Keyboard

2.2.4 Hub Unit

- AT&T StarLAN 10 Network Hub Unit (NHU)

2.2.5 Brouter

StarWAN 200 Brouter
MCI Controller card
2 Serial Network Interface Cards
2 Ethernet IEEE 802-3 Interface cards
GS2 BFX Version 8.1 (2.5)
X.25 Software
Bridging Software

2.2.6 AUI Adapter

StarLAN 10 Network AUI Adapter

2.2.7 Printer

Accel-500 dot matrix printer

2.2.8 Cables

RJ45 StarLAN Ethernet Cables
RS 232 Serial Cables
AUI

2.2.9 Modems

Codex 3600

3.1 OATS Workstation

Available Floppy Disk Drives:

A:	3.5"/1.44 MB
B:	5.25"/1.2 MB

```
C: 32 MB
D: 32 MB
E: 20 MB
```

```
640    K-bytes main memory
64     K-bytes display memory
156    K-bytes extra memory
2,272 K-bytes expanded memory
```

3.2 10 MB StarLAN NAU Card

```

IRQ:                2
I/O Address:       368
RAM Address:        D0000

```

3.3 Router Configuration

The Routers were configured to act as a bridge between the Tandem MLAD and the StarLAN 10 network. This was achieved with the following configuration:

Router A (The Tandem side)

1. Enter "enable" at the Router prompt to enter privileged user mode.
2. Enter "memory erase". This makes sure that any previous entries are cleared.
3. Enter "configure" at the Router prompt to edit the configuration details.
4. Enter "bridge 1 protocol ieee".
5. Enter interface ethernet 0".
6. Enter "bridge-group 1".
7. Enter "interface serial 0".
8. Enter "bridge-group 1".
9. Enter "^Z" (control Z). This exits configure file.
10. Enter "write memory".
11. Enter exit.

Router A is then configured.

Router B (The Starlan 10 side)

1. Enter "enable" at the Router prompt to enter privileged user mode.
2. Enter "memory erase". This clears any previous entries.
3. Enter "configure" at the Router prompt to edit the configuration details.
4. Enter "bridge 1 protocol ieee".
5. Enter interface ethernet 0".
6. Enter "bridge-group 1".
7. Enter "interface serial 1".
8. Enter "bridge-group 1".
9. Enter "^Z" (control Z). This exits configure file.
10. Enter "write memory".
11. Enter exit.

Router B is then configured.

3.4 Cabling

Workstation - Hub	RJ45 Max Length ?????
Brouter - Hub	RJ45 Max Length ?????
Brouter - AUI adapter	15 pin AUI cable
AUI Adapter - Hub	RJ45 Max Length ?????

3.4.1 DB-25 Pin Configuration

The cable should be connected with one female end (DTE) and one male end (DCE).
Only the following pins were connected:

Pin 2	(Transmitted Data)
Pin 3	(Received Data)
Pin 4	(Request To Send)
Pin 5	(Clear To Send)
Pin 6	(Data Set Ready)
Pin 7	(Signal Ground)
Pin 8	(Data Carrier Detect)
Pin 15	(Transmit Signal Element Timing)
Pin 17	(Receiver Signal Element Timing)
Pin 20	(Data Terminal Ready)
Pin 24	(External Transmit Signal Element Timing)
Pin 25	(Test Indicator)

3.5 Modems

Codex 3600, synchronous, 19.2 K Bits/sec. For modem configuration see appendix H.

4. Detailed Software Configuration

4.1 Workstation Software

AT&T StarGROUP Client version 3.3 (8 user)
AT&T MS-DOS 3.30a Version 1.01
Microsoft Windows Version 3.0
6530 Terminal Emulation

4.2 Server Software

AT&T StarGROUP Server version 3.3 (8 user)
Unix System V/386 Release 3.2.2

4.3 Loading Procedures

It is assumed that all of the OATS software will have been pre-loaded before delivery, including the installation of the server and client StarLAN software. The following is the sequence of tasks that should be carried out to connect and configure the GMCC system.

- Connect the components of the GNAS section of the system.
- Connect and configure the Routers and AUI adapters.
- Install the StarLAN NAU card into the MLAD computer, setting the IRQ, I/O Address and RAM address as outlined.
- Connect the MLAD to the Hub unit.
- Install the StarLAN client software on the MLAD. The procedure for this can be found in the StarGROUP document "StarGROUP Software - Installing LAN Manager". The following options should be selected during the installation:

Choose the install rather than the upgrade.
Select Basic DOS client from the "Select a Configuration" menu.
All software should be loaded on drive C:
Accept the default directory location.
Enter "WKS10" as the computer name.
Enter the primary server name as specified, including the .serve extension.
Do not enable the message receiver.
Do not load the network driver in expanded memory.
Do not load the DOS redirector in high memory.
Enter "Yes" to "Prompt to start network software on boot".
Enter the NAU interface board type as AT&T Starlan 10 Network PC NAU.
Enter the strap setting as they have been set up on the NAU board. They should be:
 IRQ - 2
 I/O Address - 368
 RAM Address - D0000
 Test the configuration.

Once installed, and with the server running and Brouters in place, reboot the MLAD. The MLAD will try to make a connection to the server. If the connection is successful, the message "SOFTWARE LOADING COMPLETED" should appear. The network can then be further tested by linking to the server disk.

4.4 Parameter Adjustments

These amendments need to be made to the following files:

4.4.1 OATS Workstation

Config.sys

Add the following lines:

```
device=c:\tandem\kernel.sys
device=c:\tandem\rmpcdrvr.sys
device=c:\tandem\lan6530.sys /S4 /B4096
```

These files should be supplied by Tandem. The file sizes and creation dates are shown for reference.

LAN6530	SYS	15514	12-06-90	11:10a
RMPCDRVR	SYS	10030	12-06-90	11:11a
KERNEL	SYS	2819	12-06-90	11:07a

Autoexec.bat

Add the following lines:

```
D:\lanman.dos\netprog\ql N:      \\servername.serve\u
D:\lanman.dos\netprog\ql LPT1:  \\servername.serve\accel102
```

Replace 'servername' with the name of your server.

Protocol.ini

Amend the following parameter:

```
nsess - 7
```

This will allow the workstation to open three 6530 sessions and access the Tandem Dos partition.

4.4.2 MLAD

Config.sys

Add the following lines:

```
device=c:\tandem\kernel.sys
```

These files should be supplied by Tandem. The file sizes and creation dates are shown for reference.

KERNEL SYS 2819 12-06-90 11:07a

Protocol.ini

Amend the following parameters:

nsess = 32

ncmds = 64

4.5 PCT Setup

The 6530 terminal emulation program is called PCT.EXE, and should be installed on each workstation. The Oks 1989 version should be used. The configuration program used to set up the emulation parameters is PCTC.EXE. To allow Windows 3.0 to open three copies of the same program with different parameter files, three directories had to be created under the TANDEM directory on drive C: These should be called TACL, MMS1 and MMS2. The PCT.EXE file was copied to each of these directories and renamed PCT_TACL.EXE, PCT_MMS1.EXE and PCT_MMS2.EXE, respectively. The configuration program should then be run in each of these directories to create the PCT.INI files. The following fields should be amended in the configurations:

On page 3 of 9:

```
HOST NAME      '\acta'
WINDOW NAME    '\acta.$lanl.#bdl2tcl'
```

NB. The fields in quotes are examples only. Consult with the TANDEM engineer to find out the local names that should be used. The window names should be different for each PCT session.

On page 5 of 9:

```
AUX1_DEVICE    'LPT1'
AUX2_DEVICE    'AUX2TACL'
DEVICE NAME    'LANDRVR'
```

The AUX1_DEVICE field should be set to the shared printer (if this is not set up or a non-shared printer is entered, a 'DOS ERROR: BAD STRUCTURE LENGTH' error will occur on starting the second and subsequent windows on the workstation). The AUX2_DEVICE can be set to a shared printer or to a file name. If set to a file name, this should be different in each PCT.INI set up. The DEVICE NAME must be set to LANDRVR.

The setup can be tested outside of Windows by typing in the PCT program name in the directory containing the PCT.INI file. If the network is connected correctly and functioning, it will be possible to connect to the TANDEM machine. To end the TANDEM session, type CTRL-END.

4.6 Batch files

A batch file has to be included in each of the TANDEM directories to stop multiple copies of the same program running. An example of the control batch file is shown in appendix G. This requires that the directory C:\LOCKS exists. The three batch files should be called C:\TANDEM\TACL\BAT_TACL.BAT, C:\TANDEM\MMS1\BAT_MMS1.BAT and C:\TANDEM\MMS2\BAT_MMS2.BAT.

4.7 Windows Environment

4.7.1 Program Groups

A program group should be created with the description "Tandem Applications" within the Program Manager.

4.7.2 Program Items

Three program items need to be created within the program group "Tandem Applications", one for each of the programs in the TANDEM sub directories created (ie. TACL, MMS1 and MMS2). The descriptions and command lines should be:

"Tandem TACL Window" - "C:\TANDEM\TACL\BAT_TACL.BAT"
"Tandem MMS1 Window 1" - "C:\TANDEM\MMS1\BAT_MMS1.BAT"
"Tandem MMS2 Window 2" - "C:\TANDEM\MMS2\BAT_MMS2.BAT"

4.7.3 PIF Files

PIF files need to be created to control the running of programs inside Windows, including the batch files. These PIF files are created and modified using the PIF editor found within the Windows environment. A total of six PIF files will need to be created. Example are shown for the TACL batch file PIF and the TACL PCT PIF:

TACL batch file PIF: BAT_TACL.PIF

Program Filename: C:\TANDEM\TACL\BAT_TACL.BAT
Window Title: TACL Window
Start Up Directory: C:\TANDEM\TACL
Memory Requirements: KB Required 128 KB Desired 640
Display Usage: Windowed
Execution: Background
Close Window on Exit: Yes
Background Priority: 25
Foreground Priority: 50
EMS Memory: KB Required 0 KB Desired 1024
XMS Memory: KB Required 0 KB Desired 1024
Uses High Memory Area: Yes
Video Memory: Text
Monitor Ports: High Graphics
Emulate Text Mode: Yes
Allow Fast Paste: Yes

TACL PCT PIF: PCT_TACL.PIF

Program Filename: C:\TANDEM\TACL\PCT_TACL.EXE

All other parameters should be the same as above. For the MMS1 and MMS2 PIF set up, amend the First three fields as appropriate. If the network and TANDEM applications are connected, it should now be possible to run the 6530 emulation from within the Windows environment.

4.8 Memory Management

This section is still to be completed.

4.9 Machine Names/Addresses

The following workstation names were used:

GMCC21, GMCC22, GMCC2G, GMCC23, WKS10

4.10 Printer Configuration

The printer used was the Accel-500. StarLAN 3.3 contains a printer driver for this printer. The printer should be set up from within Control Panel. The AMT ACCEL-500 on LPT1: should be selected and made active. The Network option should then be selected. Select the device LPT1: and type in the name of the shared printer name on the server in the PATH field eg. \\04800368.serve\accel102, and select connect. This will then redirect any output sent the port LPT1: to the server, which should then ne printed out on the printer attached to the server.

5. Non Standard Configurations

All components and configurations should be agreed before document release.

6. Application procedures

6.1 System Start Up

The system should be brought up in the following order:

- Make sure that The Tandem machine is fully operational.
- Start the OATS server and switch on the printer. The machine will automatically boot itself into UNIX when powered up. This will take t a few minutes. When the 'Login:' prompt appears, proceed to the next step.
- Start the MLAD computer. The machine will automatically load the network software and start the MLAD software.
- Start the windows and applications on the Tandem. The MLAD will display all open windows and sessions.
- Start the OATS workstations. These will load the network software and start Microsoft Windows.

The system should now be ready for use.

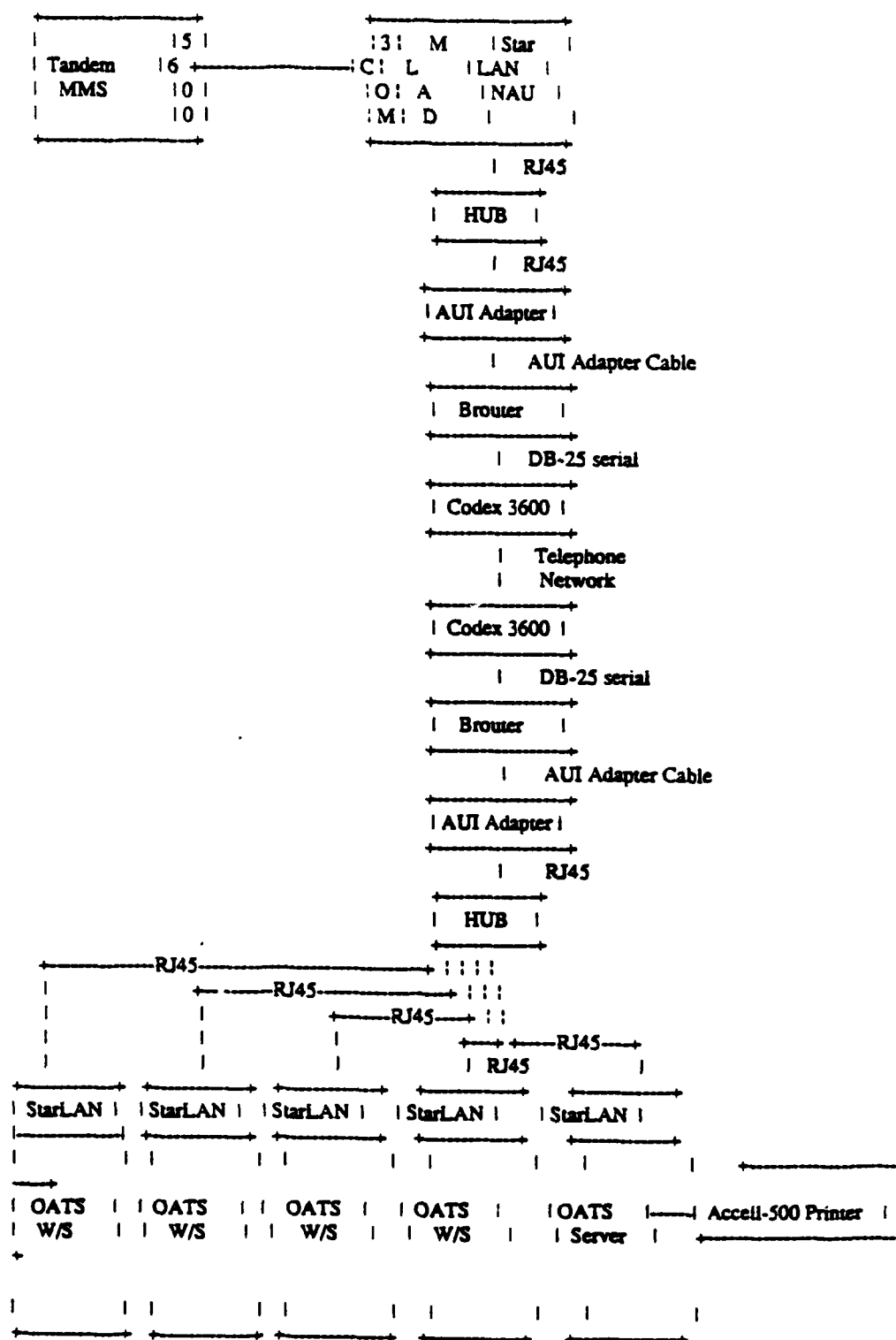
6.2 Tandem Applications

The Tandem applications (MMS and TACL) are available through Microsoft Windows on the OATS workstations. They can be accessed through the 'Tandem Applications' Icon within the 'Program Manager". By double-clicking on this Icon , the contents will be displayed. There are two MMS windows available and one TACL windcw. To run one of the options, point to it with the mouse and double-click on the option. This will open a window into the selected application. To close these applications, press Ctrl-End. If the same option is selected before the window is closed a message will appear in a window saying the application is already running. It is not possible to exit Windows while any of the Tandem applications are running.

Appendix A - System Configuration - Direct Connect



Appendix B - System Configuration - Through Routers



Appendix C - Workstation Config.sys example

```
device=c:\tandem\kernel.sys
device=c:\tandem\rmpcdrvr.sys
device=c:\tandem\lan6530.sys /S4 /B4096
device=c:\dev\sstbio.sys /we
device=c:\dev\sstdrive.sys
device=c:\dev\fixmem.sys
device=c:\dev\386max.sys pro=c:\dev\max.pro
device=d:\lanman.dos\drivers\protman.dos /i:d:\lanman.dos\drivers\star10
device=d:\lanman.dos\drivers\attload.dos /n
device=d:\lanman.dos\drivers.\attiso\attiso.dos
device=c:\dev\386load.sys prgreg-1 prog=d:\lanman.dos\drivers\attcsma\attcsma.dos
shell=C:\command.com /e:384 /p
stacks=0,0 # WARNING: MODIFICATION TO ANY PARAMETERS, THEIR or
lastdrive=N # LOADING ORDER MAY RESULT IN UNWANTED
buffers=20 # INCLUDING BOOT TIME ERRORS, SYSTEM HANGS and.
files=40 # OATS BOOT CONFIG @(#)CPP File config.cpp 2.3@(#) - 7/18/90 VJC
```

Appendix D - Workstation Autoexec.bat example

```
@echo off
rem #####
rem # RESTRICTED RIGHTS NOTICE
rem #
rem # Use, reproduction, or disclosure of software is subject to
rem # restrictions set forth in Contract No. DTFA01-90-D-00009
rem # with American Telephone and Telegraph Company.
rem #
rem # Unpublished--rights reserved under the Copyright Laws
rem # of the United States
rem #####
rem # For support, please do not remove the following block of lines.
rem # AUTOEXEC.BAT: ID: @(#) CPP File autoexec.cpp 2.4 @(#)
rem # LD: 2/24/91 16:16:02
rem # LG: 2/24/91 16:16:59
rem # BUILD: Thu Mar 21 13:27:54 EST 1991
rem # DOSS: 124
rem # WKST: dan
rem # HASSLE: 3.0
rem # Thank you from your AT&T OATS Team.
rem #####
set attlanroot=D:\lanman.dos
set path=%attlanroot%\netprog;
attstart
C:\utl\386load prgreg-2 envsave prog=C:\DOS\share.exe
C:\utl\386load prgreg-2 envreg-3 flexframe prog=C:\utl\mouse.com
C:\utl\386load prgreg-4 envsave prog=D:\lanman.dos\netprog\prtsc.exe
rem #
rem # Standard Environment
rem #
set comspec=C:\command.com
prompt=$p$g
```

```

set helpdirpath=C:\DOS\helpdir
set path=C:\DOS;C:\;C:\utl
rem #
rem # Include MS-Windows in the Path
rem #
set path=C:\win;%path%
set temp=C:\tmp
rem #
rem # Include Microsoft Excel in the path
rem #
set path=C:\win\excel;%path%
rem #
rem # Include Microsoft Word for Windows in the path
rem #
set path=C:\win\winword;%path%
rem #
rem # Place your own PATH entries in here with statements like
rem #     set path=%path%;YOUR-PATH-ADDITION
rem # Remember, the length of the PATH is limited. Refer to your
rem # MS-DOS documentation for more information.
rem #
rem #
rem # You have installed LAN Manager Client software or Remote
rem # PC Client software.
rem # In order to access the LAN file server, a Quick Link to LAN Server
rem # must be made.
rem #
rem # Replace the Lan_SerVe place holder
rem # with the name of the server that acts as your File Server.
rem #
D:\lanman.dos\netprog\ql N: \\04800368.serve\u
D:\lanman.dos\netprog\ql LPT1: \\04800368.serve\accel102
rem #
rem # Put the Network Drive at the End
rem #
set path=%path%;N:
rem #
rem #
rem # Packrat (Networked) Link-Up to Server
rem # In order to use networked Packrat, a Quick Link
rem # to your Packrat server must be made. Replace the
rem # PaCkRaT_SerVe placeholder with the name of your
rem # Packrat server. Refer to the Packrat documentation
rem # for more information and ask your local network
rem # administrator for help.
rem #
set path=%path%;K:\
D:\lanman.dos\netprog\ql K: \\04800368.serve\packrat
rem #
rem # Standard Environment
rem #
set path=%path%;
rem #
rem # Clear old lock files

```

[illegible]

Appendix E - Workstation lanman.ini example

```
;*
;* AT&T StarGROUP(TM) NETWORK CONFIGURATION FILE
;* This file is used by the ENHANCED CLIENT
;*
;* Release 3.3 1989
;*
;* NOTE: Comments begin with a ';' and MUST begin in the first column.
;*
;*****
[networks]
  netservices          - minses, vertbl
[workstation]
  wrkservices          -
  charcount            - 16
  chartime             - 250
  charwait             - 128
  computer name        - gmcc22
  himem                - yes
  keepapis             - yes
  langroup             - langroup
  lanroot              - D:\lanman.dos
  logonserver          -
  mailslots            - yes
  numcharbuf           - 2
  nummailslots         - 2
  numresources         - 8
  numservers           - 10
  numviewbuffers       - 2
  numviewedservers     - 50
  numworkbuf           - 3
  optimizations       - 3
  pr1buffsize          - 256
  pr2buffsize          - 128
  pr3buffsize          - 128
  singlercvbuf         - 0
  sizcharbuf           - 128
  sizworkbuf           - 2048
[netshell]
  username             - GUEST
;      Ba|Hi|Gr|En|Di|Al|DB|PB|BD|LB|SB|El|MB|Me|Ms|Mh|mh|ih|DA|Sh|
;  colors - 070170702030031430030030713710710712030030300431401670431002
;  colors -
[att]
ATTRIBUTES=0,15,7,0,0,15,112,0,0,112,112
  attutils             - setblt, nps, netmsg
  bootpref             - n
  configname           - ENHANCED
  logonpref            - yes
  maxmsgsz             - 128
  redirver             - 3.3
  primaryserver        - servname.serve
  public               - u
```

```

release                - R3.3
[attservices]
netmsg                 - services\loadmsg.exe
netstart               - \netstart.bat
nps                    - netprog\nps.exe
prtsc                  - netprog\prtsc.exe
setblt                 - netprog\setblt.exe
ql                     - netprog\ql.com
[services]
minses                 - netprog\loadmin.exe
netbind                - drivers\netbind.exe
vertbl                 - netprog\loadtbl.exe
workstation            - netprog\loadrdr.exe

```

Appendix F - Workstation protocol.ini example

```

[protocol manager]
    drivename          - PROTMAN$
[attiso]
    drivename          - ATTISO$
    bindings           - attcsma
    nsess              - 7
    ncmds              - 12
    use_emm            - y
[attcsma]
    drivename          - attcsma$
    board_type         - 1
    irq                - 2
    ioaddr             - 0x368
    daram              - 0xD000

```

Appendix G - Batch control file

```
@echo off
rem #####
rem #                RESTRICTED RIGHTS NOTICE
rem #
rem #  Use, reproduction, or disclosure of software is subject to
rem #  restrictions set forth in Contract No. DTFA01-90-D-00009
rem #  with American Telephone and Telegraph Company.
rem #
rem #  Unpublished--rights reserved under the Copyright Laws
rem #  of the United States.
rem #
rem #####
rem #  PCT MMS1 Window Batch File                April 30 1991
rem #####

rem CHECK IF LOCK ALREADY EXISTS
IF exist C:\LOCKS\PCT_TACL GOTO :LOCKED

rem CREATE LOCK
ECHO PCT MMS1 > C:\LOCKS\PCT_MMS1

rem RUN PROGRAM
C:
CD \TANDEM\MMS1
PCT_MMS1.PIF
ERASE C:\LOCKS\PCT_MMS1
GOTO :END
:LOCKED

rem ALREADY LOCKED - PUT OUT MESSAGE AND RETURN
:LOCKED
ECHO I#####
ECHO |
ECHO |      PCT MMS1 Window is already running.      |
ECHO |
ECHO E#####
D:\NU\BE ASK "" TIMEOUT=2
GOTO :END
:END
```

Appendix H - Modem Configuration

The following configuration parameters were set on the modems. One modem was defined as the master and the other as a slave. Any differences in the configuration have been noted.

i) Config.

a) DEVICE

Mode	3600
Max Rte	19.2
Port	1

b) ANALOG

1) LS ANG

Op Mode	TURBO PP
Rate	19.2
Tx Lvl	-15DBM
CD/THR	-26/-31
LS STP	0000000

2) SW ANG

SW CNFG	UNIQUE
Op Mode	TURBO PP
Rate	19.2
TELCO	PERMISIV
CD/THR	-43/-48
SW STP	0000000

3) DTE+

MUX MOD	A	
V33 MUX	LOC PROG	
TIMING	INTERNAL (MASTER)	LOOPBACK (SLAVE)
SPD CTL	NORMAL	
DTE STP	0000	

c) PORTS

1) Port 1

DATA/CL	SYNC INT
P1 STP1	00000000
P1 STP2	00000010

d) NWK CTL

ADDRESS	01 (MASTER)	02 (SLAVE)
NC RTE	75BPS	
DCE RTE	75BPS	
NC STP1	00000000	

e) RESTORL

1) DIAL+

MODE	ANSWER
DL TYPE	AUTO
DTR REQ	NO

SECURE	DISABLE
1STCALL	REM TX
QK CONN	ENABLE
PAUSE D	4 SEC
ABT FRQ	2100HZ

2) INIT+

AUTO RST	DISABLE
LL DCD	15 SEC
LL UI	ENABLE
DTR RST	DISABLE
SL STBY	DISABLE

3) TERM+

AUTOTRM	ENABLE
RST DCD	15 SEC
RST UI	ENABLE
HC LOSS	SHORT
TRM TNN	DISABLE

4) PHONE#

REM TX1	9
REM TX2	4
REM RX3	?
REM TX4	?
REM TX5	?

ii) Remote

a) CONNECT

REM ADD	00
SEND	

b) ASSIGN

REM ADD	00
S/N	0
SLOT NO	0
SEND	

c) SEARCH

S/N	0
SLOT NO	0
SEND	

d) MISC

OVERIDE	ENABLE
PROTECT	DISABLE
TIMEOUT	ENABLE
LOGOUT	

e) MESSAGE

ADDRESS	00
NUMBER	00
SEND	

Documentation for testing
of MULTILAN/STARLAN
conducted at the F.A.A.
Technical Center

During the weeks starting on March 18, 1991 and ending on April 17, 1991, testing was conducted at the Technical Center to determine the viability of utilizing the A.T. & T. Office Automation Technology Systems (OATS) equipment to access TANDEM based applications via the MULTILAN NETBIOS gateway product.

The purpose of this testing was to determine if this 'off-the-shelf' hardware/software could be utilized to provide the required connectivity for the MCC GNAS project. The intent of this document is to provide sufficient detail of the TANDEM hardware/software configuration to enable the reader to replicate the tested configuration.

This document will only briefly describe the STARTLAN component of the hardware/software LAN environment. The STARTLAN LAN environment will be described in a separate document prepared by the A.T. & T. sub-contractor, DATRONICS.

This document assumes that the user is familiar with the TANDEM host application, PATHWAY, PATHCOM, SCF, and other utilities. If further information is required in these areas, please reference the appropriate application manual.

HARDWARE

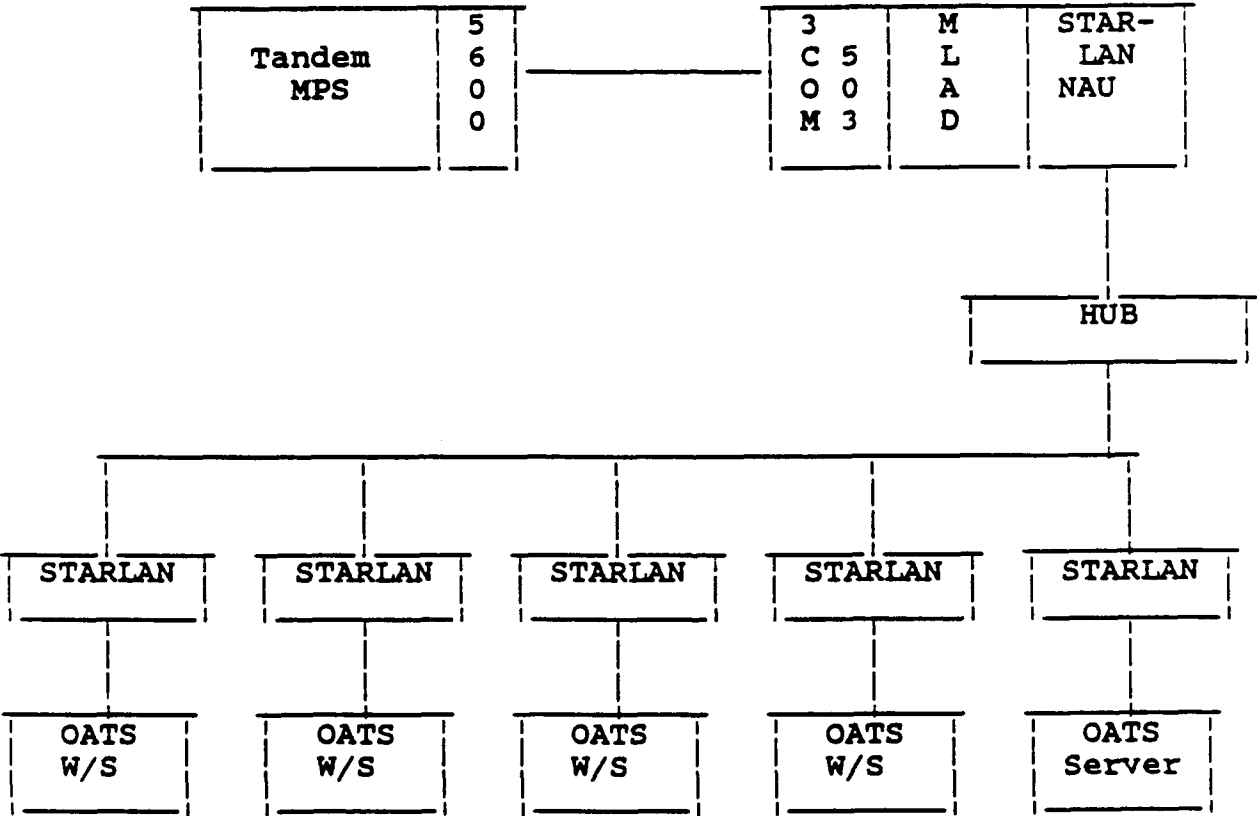
Overview

During the first three weeks of our testing, we were given only one A.T. & T. STARTLAN 10 PC LAN adapter for the two MLADS. Although other PCs, with STARTLAN 10 adapters installed were available, we were not permitted to use them. This severely limited the scope of our test during that period.

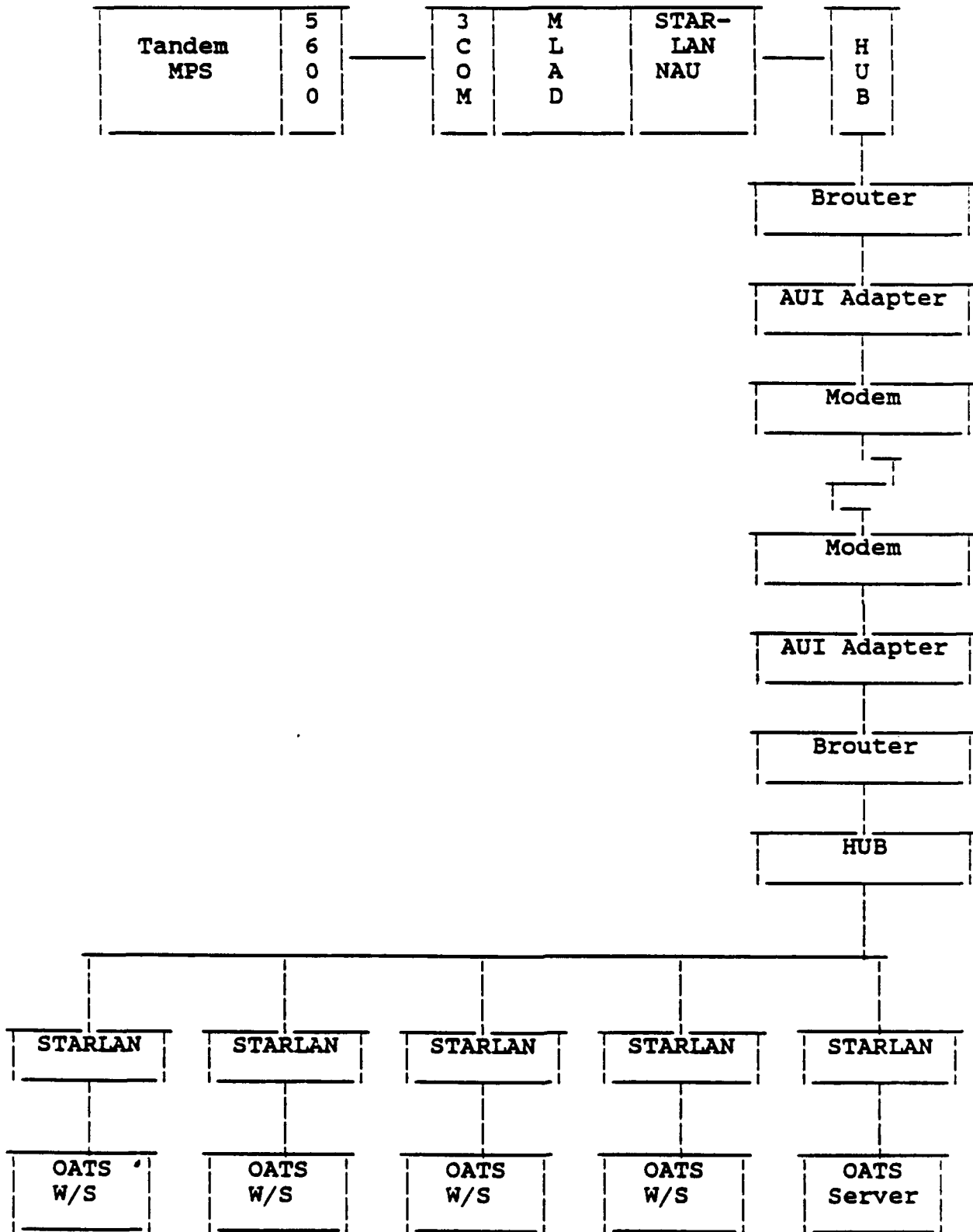
Limited to one STARTLAN 10 PC adapter card, we were able to test connectivity to the TANDEM in only the single MLAD configuration. Using the single MLAD, we tested connectivity in two configurations:

1. Configuration #1 (pg. 3) consisted of a local LAN setup with the MLAD gateway attached directly to the HUB of the STARLAN.
2. Configuration #2 (pg. 4) included two A.T.&T. communication routers, called BROUTERS. The two BROUTERS were connected via modems to an analog circuit configured to simulate a leased circuit in a Wide Area Network (WAN). The BROUTERS were employed to provide a LAN communication bridge from the LAN (remote) to the MLAD gateway (local).

Configuration #1 - Direct Connect (local LAN)



Configuration #2 - Through BROUTERS



Overview (cont.)

Later, we were supplied with five additional workstations. We extracted the STARLAN 10 adapter from one of the five workstations and placed the card into the second MLAD. This limited our second GNAS configuration to three (3) CLIENTs and one (1) DISK SERVER.

The anticipated GNAS LAN configuration is expected to consist of four (4) CLIENT workstations and one (1) DISC SERVER. Each Air Route Traffic Control Center (ARTCC) would support a maximum of four remotely located GNAS MCC LAN setups. Additionally, the possibility exists for a local LAN setup, known as the AMCC, to require access to the TANDEM.

We recommended that the FAA perform testing with a configuration containing the full range of devices expected to be supported by the maximum configuration. Due to lack of available equipment, the FAA decided to proceed with the testing using the available equipment.

TANDEM Connectivity Components

The 5600 Ethernet controller, the controller cable which runs from the controller to the EMI patch panel, the transceiver cable which runs from the EMI patch panel to the TRANSCEIVER, the transceiver, and the ETHERNET coaxial cable to the 3COM 503 cards inside the two MLADs had already been installed by the TANDEM CE prior to our arrival.

In both MLADs, the 3COM 503 card was jumpered according to the factory settings. The factory setting for the I/O base address is 300h. The factory setting for the memory base address is 'disable'. All software options were allowed to assume the default settings.

All STARLAN 10 adapter cards were installed with an I/O base address of 368h. The memory base address was set to D0000.

The 3COM adapter assumed IRQ 4 and the STARLAN 10 adapter was set to assume IRQ 2.

HARDWARE

LIMITATIONS

We were eventually supplied with the following hardware components:

1. Nine A.T.&T. 386 workstations. Two (2) were designated as the LAN DISK SERVERS, and the other seven (7) were set up as LAN CLIENTS. We were informed that each GNAS MCC would contain one SERVER and four CLIENTS, so we would only be able to configure one complete GNAS MCC site.
2. Two A.T.&T. BROUTERS.
3. Two STARLAN HUBS.
4. Two sets of cables for connecting the BROUTERS to the HUBS.
5. One STARLAN 10 LAN adapter card for each of the nine workstations.
6. Two MLADs each equipped with a 3COM 503 adapter for connection to the TANDEM based 5600 LAN controller.
7. Two STARTLAN 10 LAN adapter card for the MLADS. Each MLAD should be able to support two NETBIOS LAN adapter cards. In the case of the STARTLAN cards, this would limit each gateway (MLAD) to supporting 32 names and 64 sessions. We tested with only one STARLAN 10 adapter per MLAD, limiting each MLAD to 16 names and 32 sessions.

Since we were testing with a limited subset of the devices expected in the maximum configuration, the FAA was reluctant to pass the system without specifying that the Design Qualification Test and Evaluation (DQT&E) was hampered by lack of equipment.

However, given the results of our testing, we do not anticipate problems as more GNAS MCC sites are added. The communications circuit bandwidth (@19,200bps) should throttle the activity for each GNAS MCC LAN added.

SOFTWARE

Software Versions

MLAD	T9377C20 16FEB90
PC6530	G21
MultiLan Host Software	C20
MSDOS	Version 3.30a
MS Dos LAN Manager Protocol Manager	V1.1
MS Dos LAN Manager Netbind	V1.1
AT&T StarGROUP (TM) 82586 CSMA Driver	Version 3.30a
AT&T StarGROUP (TM) OSI Netbios Driver	Version 3.30a
SMB Compatible	: Yes
Netbios Names	: 16 per Adapter
Netbios Sessions	: 32 per Adapter
Adapter per MLAD	: 1
Host Adapter Type:	3Com 503 or 501

CONFIGURATION for the MLAD Gateway

After the STARTLAN software was loaded on the MLAD, the config.sys and autoexec.bat were set as follows:

C: CONFIG.SYS

```
files=20
buffers=20
DEVICE=c:\tandem\KERNEL.SYS
LASTDRIVE=N
SHELL=C:\COMMAND.COM /e:384 /p
device=c:\lanman.dos\drivers\protman.dos/i:c:\lanman.dos
\drivers\star10
device=c:\lanman.dos\drivers\attload.dos /Y
device=c:\lanman.dos\drivers\attcsma\attcsma.dos
device=c:\lanman.dos\drivers\attiso\attiso.dos
```

C: AUTOEXEC.BAT

```
@echo off
break=on
path=c:\;c:\dos;c:\mlad;c:\utils;
prompt $p$g
ver
path=%attlanroot%\netprog;%path%
:REM ***** AT&T StarGROUP(TM) Software - Do Not Modify *****
SET ATTLANROOT=c:\lanman.dos
PATH=%ATTLANROOT%\netprog;%PATH%;\\04800368.SERVE\U
ATTSTART
cd \
cd \mlad
pause
:
: mlads -a1 -g#PITa0 -S32 -C64   For the Pittsburgh GNAS.
:                               or
: mlads -a1 -g#ACYa0 -S32 -C64   For the Atlantic City GNAS.
```

MLAD Configuration Notes

The gateway name in the MLADS command must match the name specified in the TANDEM SCF 'ADD GATEWAY' command discussed later (i.e. -g#PITa0 or -g#ACYa0 in our examples).

The -S32 and the -C64 must match the 'nssess' and the 'ncmds' entries in the \LANMAN.DOS\DRIVERS\STAR10\PROTOCOL.INI file installed on the MLAD as part of the AT&T STARTLAN configuration. Note that the 'nssess' entry (number of sessions) in the PROTOCOL.INI file will effect the number of sessions which can be established via the MLAD. Each PC uses some of these sessions for LAN based functions.

At one point, we were receiving 'CSS error 4' from the emulator (PCT) while attempting to start a third window via the WINDOW 3.0 manager. Increasing the number of sessions on the workstation adapter by incrementing 'nssess' solved the problem.

The C:\TANDEM subdirectory contains the G21 release of the EM6530 product. The diskette containing this release of EM6530 should be delivered with the MULTILAN product.

Be sure to use the KERNEL.SYS contained with the G21 release (not the old KERNEL.SYS contained on the MULTILAN diskette). The older release of KERNEL.SYS included on the MULTILAN diskette is not compatible with the G21 LAN6530.SYS. This is important when installing the drivers on the LAN workstation.

The MLADS.EXE was taken from the SUT delivered with the 5600 controller. The version we used contained a version of T9377C20^16feb90^16feb90. This version number will also appear as the banner on the MLAD once started.

LAN Based Workstations

After the installation of the AT&T STARLAN network software on the workstation, the CONFIG.SYS contained the following:

```
device=c:\tandem\kernel.sys          # TANDEM G21 kernel
driver
device=c:\tandem\rmpcdrvr.sys        # TANDEM G21 resource
manager defaults
device=c:\tandem\lan6530.sys /S4 /B4096 # TANDEM G21 lan driver

4 sessions
device=c:\dev\sstbio.sys /we
device=c:\dev\sstdrive.sys
device=c:\dev\fixmem.sys
device=c:\dev\386max.sys pro=c:\dev\max.pro
device=d:\lanman.dos\drivers\protman.dos
/i:d:\lanman.dos\drivers\star10
device=d:\lanman.dos\drivers\attload.dos /n
device=d:\lanman.dos\drivers.\attiso\attiso.dos
device=c:\dev\386load.sys prgreg=1
prog=d:\lanman.dos\drivers\attcsma\attcsma.dos
shell=C:\command.com /e:384 /p
stacks=0,0 # WARNING: MODIFICATION TO ANY PARAMETERS, THEIR
VALUES, or
lastdrive=N #          LOADING ORDER MAY RESULT IN UNWANTED
SYSTEM BEHAVIOR,
buffers=20 #          INCLUDING BOOT TIME ERRORS, SYSTEM HANGS
and CRASHES.
files=40 # OATS BOOT CONFIG @(#)CPP File config.cpp 2.3@(#) -
7/18/90
```

The first three entries represent the TANDEM drivers required for MULTILAN connectivity.

TANDEM device drivers

The KERNEL.SYS device driver creates a multitasking environment for the PC based software. KERNEL.SYS must be loaded before RMPCDRVR.SYS and LAN6530.SYS.

The RMPCCOM.SYS device driver establishes a session between the PC and the TANDEM based MultiLan Resource Manager (MLRM) via the session associated with the ZHME1 application name.

The session is used by RMPCCOM for logging onto the system. LAN6530 also uses this session to establish dynamic and static windows (note: addition of each window results in addition of an application name to the MLAD resident LAN adapter card).

The session is established when the named resource is utilized i.e.- an application is run against the added window).

The LAN6530.SYS device driver establishes multiple terminal emulation (PCT) sessions (depending on the /Sx parameter) via dynamic or static windows.

SOFTWARE ON the TANDEM (host)

SYSGEN

The MACRO:

```
MLMUX^MACRO = MLAM TYPE          56,  
               SUBTYPE           0,  
               RSIZE             32000,  
               PROGRAM           C9376P00,  
               MAXREQUESTSIZE    32000,  
               LINEBUFFERSIZE    32,  
               BURSTSIZE         16,  
               INTERRUPT         IOP^INTERRUPT^HANDLER #;
```

In the CONTROLLER section:

```
LAMA          5600          2,3          %350; !MULTILAN  
                                           CONTROLLER
```

In the PERIPHERAL section:

```
$LAM1        LAMA.0,LAMA.1MLMUX^MACRO,NAME #LAN0001; !MULTILAN  
                                           LINE
```

SOFTWARE ON the TANDEM (host)

STARTUP

You should have a Subsystem Control Process (SCP) running to support your SCF interface. If one has not been created, you can start one as follows :

```
stop $ZNET
SCP/NAME $ZNET,PRI 150,NOWAIT,CPU 1/2;autostop -1
```

Start the TLAM Manager. This NonStop process pair provides the internal programmatic interface for configuration and network management of TANDEM LAN access software communications subsystems. There is only one MLMAN process pair per TANDEM system and it's PPD name should always be \$ZLMG.

```
stop $ZLMG
MLMAN/NAME $ZLMG,PRI 198, CPU 3,NOWAIT/2
```

Start a Multilan Resource Manager (MLRM).

```
stop $ZMRM
MLRM/NAME $ZMRM,PRI 197,CPU
```

Use Subsystem Control Facility (SCF) to add and initiate the subsystem objects.

```
SCF/IN $SYSTEM.MULTILAN.DOMAIN/
```

Where the file DOMAIN would contain commands to accomplish the following for each GNAS. For exact file contents see:

```
\ACTA.$system.Multilan.domain which is secured for
network access ).
```

```
allow all errors          ! allow for error conditions
start line $lam1          ! insure line is started
```

STARTUP (continued)

During our testing we assumed that each GNAS would be considered one domain, so we named the DOMAIN after the Pittsburgh GNAS (PIT).

```
add domain $lam1.#PIT,default
```

We were only supplied one LAN adapter card, so we named the gateway after adapter zero in that gateway.

```
add gateway $lam1.#PITA0,type mlad,domain #PIT
```

We assumed the workstations would be named according to the GNAS in which they were contained.

```
add WS $lam1.#PIT1,domain #PIT
```

Then we added three windows for each workstation. One for TACL, one for MMS, and one for MMS.

```
add window $lam1.#PIT1MCs,WSname #PIT1
delay 2
add window $lam1.#PIT1MMS,WSname #PIT1
delay 2
add window $lam1.#PIT1TCL,WSname #PIT1
delay 2
```

Note : Once we added the BROUTER we noticed that the Netbios Add Name requests were not being handled

quickly enough, so we added a 2 second delay between each add. This seemed to be sufficient.

\new

SOFTWARE ON the TANDEM (host) :

DOMAIN commands (continued) :

SCF

We then added the remaining windows with the following commands:

```
add WS $lam1.#PIT2, domain #PIT
```

```

add window $lam1.#PIT2MCs,WSname #PIT2
delay 2
add window $lam1.#PIT2MMs,WSname #PIT2
delay 2
add window $lam1.#PIT2TC1,WSname #PIT2
add WS $lam1.#PIT3, domain #PIT
delay 2
add window $lam1.#PIT3MCs,WSname #PIT3
delay 2
add window $lam1.#PIT3MMs,WSname #PIT3
delay 2
add window $lam1.#PIT3TC1,WSname #PIT3
delay 2
add WS $lam1.#PIT4, domain #PIT
add window $lam1.#PIT4MCs,WSname #PIT4
delay 2
add window $lam1.#PIT4MMs,WSname #PIT4
delay 2
add window $lam1.#PIT4TC1,WSname #PIT4
delay 2

```

Now that objects were added, and the application names were successfully added to the MLAD adapter, we initialized the objects by issuing the start command.

```
start line $lam1,sub all
```

\new

```
SOFTWARE ON the TANDEM (host) :
```

```
-----
Adding the application windows :
```

```
-----
We wanted to have applications running against the windows, so we added the application items using PATHCOM.
```

Since the application code we were using supported only a four TCP configuration, we added the each 'terminal' to the TCP with the same number as the workstation number. This was done intentionally so that a problem impacting a particular TCP (i.e.-CPU crash) would only disable one workstation at the GNAS. A given workstation

number at each GNAS would be associated with the Mn-TCP on the MPS (where n is the terminal number).

```
PATHCOM /in \ACTA.$system.mmslan.LANCONF/ $MMS
```

Where the file LANCONF would contain the following entries for each GNAS MCC :

Set up the default values to be used for both MMS and MCS applications.

```
SET TERM      DISPLAY-PAGES 5
SET TERM      INITIAL MMSINIT
SET TERM      TMF ON
SET TERM      AUTORESTART 0
SET TERM      TYPE T16-6530
```

Declare the individual terminals to support the MMS application.

```
SET TERM      FILE $lam1.#PIT1mms
SET TERM      TCP M1-TCP
SET TERM      PRINTER $S.#PIT1
ADD TERM      PIT1MMS
```

```
SET TERM      FILE $lam1.#PIT2mms
SET TERM      TCP M2-TCP
SET TERM      PRINTER $S.#PIT2
ADD TERM      PIT2MMS
```

```
SET TERM      FILE $lam1.#PIT3mms
SET TERM      TCP M3-TCP
SET TERM      PRINTER $S.#PIT3
ADD TERM      PIT3MMS
```

```
SET TERM      FILE $lam1.#PIT4mms
SET TERM      TCP M4-TCP
SET TERM      PRINTER $S.#PIT4
ADD TERM      PIT4MMS
```

\new

SOFTWARE ON the TANDEM (host) :

Adding the application windows (continued) :

Declare the individual terminals to support the MMS application.

```
SET TERM      FILE $lam1.#PIT1mCs
SET TERM      TCP M1-TCP
SET TERM      PRINTER $S.#PIT1
ADD TERM      PIT1McS
```

```
SET TERM      FILE $lam1.#PIT2mCs
```

SET TERM
SET TERM
ADD TERM

TCP M2-TCP
PRINTER \$S.#PIT2M
PIT2McS

SET TERM
SET TERM
SET TERM
ADD TERM

FILE \$lam1.#PIT3mCs
TCP M3-TCP
PRINTER \$S.#PIT3M
PIT3McS

SET TERM
SET TERM
SET TERM
ADD TERM

FILE \$lam1.#PIT4mCs
TCP M4-TCP
PRINTER \$S.#PIT4M
PIT4McS

SOFTWARE ON the TANDEM (host) :

Adding the application windows (continued) :

Then we started the sessions with the following command.

PATHCOM/ in STARTWIN/ \$MMS

Where STARTWIN would contain the following commands for each GNAS MCC :

```
start term PIT1mms
start term PIT2mms
start term PIT3mms
start term PIT4mms
start term PIT1mcs
start term PIT2mcs
start term PIT3mcs
start term PIT4mcs
```

A TACL process was then started as follows for each GNAS MCC:

```
tacl/in $lam1.#PIT1tcl,out $lam1.#PIT1tcl,name
$PITt1,nowait,pri 150,cpu 3/2
```

```
tacl/in $lam1.#PIT2tcl,out $lam1.#PIT2tcl,name
$PITt2,nowait,pri 150,cpu 2/3
```

```
tacl/in $lam1.#PIT3tcl,out $lam1.#PIT3tcl,name
$PITt3,nowait,pri 150,cpu 0/1
```

```
tacl/in $lam1.#PIT4tcl,out $lam1.#PIT4tcl,name
$PITt4,nowait,pri 150,cpu 1/0
```

We found that it was extremely useful to use the naming convention shown in the above examples. Each name identified the domain, window, workstation, and application whenever a problem occurred.

The actual startup files we used in our testing can be found on \ACTA.\$SYSTEM in the MULTILAN and MMSLAN subvolumes. The MMSLAN subvolume contains the startup and configuration used for the PATHWAY application. The MULTILAN subvolume contains the remaining files (including this file).

SOFTWARE ON the TANDEM (host):

Adding the TANDEM SERVER environment:

The TANDEM system administrator created a user id under the MMS user group called 'MMS.GMCC' and gave it a password of 'GMCCUSER'.

The TANDEM server environemnt was to be located in \ACTA.\$DATA2.DOSDISK subvolume. Logged on as 'MMS.GMCC' and in the \$data2.dosdisk subvolume, we created the two necessary files by entering the following FUP command:

```
FUP/in $system.sys17.MLSRVFUP/
```

This created the DOSENT and DOSACC files needed to manage the DOSDISK.

The STARTSRV file contains the startup info we used for the MultiLan Server (MLSRV).

The STARTSRV file contained the following:

```
MLSRV/name $msrv,in CMDS,cpu 2,pri 160/
```

where CMDS contains:

```
backupcpu 3
memory 2500000
lan adapter $lam1.#PITa0.0 1
share dosdisk = \ PWD /rwc
share PIT1dos = \PIT1 pswdP1 /rwc
share PIT2dos = \PIT2 pswdP2 /rwc
share PIT3dos = \PIT3 pswdP3 /rwc
share PIT4dos = \PIT4 pswdP4 /rwc
share guard = GUARDIAN /1800
share sread = SPOOLERREAD $spl /US7
share swrite = SPOOLERWRITE $s.#lp /us7 /$spl
cache files 10 read
```


SOFTWARE ON the TANDEM (host):

Adding the TANDEM SERVER environment:

At the workstation we added the following commands to the AUTOEXEC.BAT file:

```
RMPCCOM SET HOST \ACTA
RMPCCOM LOGON @\ACTA MMS.GMCC,GMCCUSER

net use f: \\acta_msrv01\dosPIT1 pswdP1
net use g: \\acta_msrv01\guard
net use h: \\acta_msrv01\sread
net use lpt2: \\acta_msrv01\swrite
```

On the first workstation we did a 'net use' on the 'dosdisk'sharename. We then created the subdirectories to be assigned to each workstation i.e.-\PIT1,\PIT2,\PIT3,\PIT4) using the MKDIR command.

We assumed that each workstation would have a unique and separately secured DOS partition. If you decided to allow all workstations to share a single DOS partition, you could specify the 'net use' as follows:

```
net use f: \\acta_msrv01\dosdisk PWD
```

Missing Software:

During the Memphis GNAS MCC testing, an addition was made to the I.M.C.S. software to allow for a WSPTP connection to a BORLAND Turbo C program running on one of the workstations. This software combination is referred to as the 'status board'.

I requested this software from the FAA people at the technical center. Joe Salvatore, of the FAA, supplied me with some of the P.C. source code. The diskette containing the software was unreadable in certain sectors, and, as a consequence, the TANDEM TAL WSPTP application could only be partially restored.

I then requested that Jay Jones send me a copy of this software from Memphis. Jay agreed to do so. I have not yet received the tape.

The 'status board' software will have to be tested at later date.

APPENDIX C

PROGRAM TROUBLE REPORTS (PTRS)

Report No. PTR-01	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT2.4 - UNIX V Software Checkout		
Test Step Description: Run KERMIT software.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: KERMIT SOFTWARE NOT OPERATIONAL.				
Detailed Description: Although an icon for the KERMIT communications software program existed in the directory, the application would not run. This prevented the user from accessing UNIX on server.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status 1. _____ Date: ____/____/____ 2. _____ Date: ____/____/____				
Closure Description: _____ _____				
Approved: Test Director _____				

Report No. PTR-02	Project GMCC	Subsystem	Test Date 04/23/91	Create Date 05/10/91						
Report By: C.Stewart		Test Sequence ID DQT2.6 - MicroGate Emulator Checkout								
Test Step Description: In MMS2 environment.										
<table border="0"> <tr> <td>Category of Failure (circle one)</td> <td>I critical</td> <td>II major</td> <td>III minor</td> <td>IV annoyance</td> <td>V other</td> </tr> </table>					Category of Failure (circle one)	I critical	II major	III minor	IV annoyance	V other
Category of Failure (circle one)	I critical	II major	III minor	IV annoyance	V other					
Brief Description: KEYBOARD LOCKUP OCCURRED.										
Detailed Description: A keyboard lockup occurred when the screen updated at the same time that a key entry was made. The application had to be exited and restarted. The key entry was lost. This situation occurs on the Tandem terminal as well.										
Test Engineer <u>Craig Stewart</u>										
Disposition Instructions:										
Follow-up Status										
1. _____				Date: <u> </u> / <u> </u> / <u> </u>						
2. _____				<u> </u> / <u> </u> / <u> </u>						
Closure Description: _____ _____										
Approved: Test Director _____										

Report No. PTR-03	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT2.8 - PackRat Software Checkout		
Test Step Description: Run PackRat software.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: PACKRAT SOFTWARE NOT INSTALLED.				
Detailed Description: No icon exists for the PackRat software program.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status 1. _____ Date: ____/____/____ 2. _____ Date: ____/____/____ Closure Description: _____ _____				
Approved: Test Director _____				

Report No. PTR-04	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT2.9 - Back-It Software Checkout		
Test Step Description: Format 1.2MB floppy disk in A: drive.				
Category of Failure (circle one)	I critical	II major	III minor	IV annoyance
				V other
Brief Description: FORMAT ERROR OCCURRED.				
Detailed Description: When formatting a high-density floppy disk in the A: drive, the message "ESC PRESSED OR TIME-OUT ERROR" kept appearing and stopping the format process. The disk would eventually format after repeating the format attempt.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status				
1. _____			Date: <u> </u> / <u> </u> / <u> </u>	
2. _____			Date: <u> </u> / <u> </u> / <u> </u>	
Closure Description: _____ _____				
Approved: Test Director _____				

ACN-250/CTA/051091

Report No. PTR-05	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT2.9 - Back-It Software Checkout		
Test Step Description: Backup files to B: drive.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: BACKUP LOOKS AT WRONG DRIVE.				
Detailed Description: With a floppy disk in the B: drive, a backup attempt to the B: drive attempts to copy files to the empty A: drive. The backup is successful on the second attempt.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status 1. _____ Date: <u> </u> / <u> </u> / <u> </u> 2. _____ Date: <u> </u> / <u> </u> / <u> </u> Closure Description: _____ _____ Date: <u> </u> / <u> </u> / <u> </u>				
Approved: Test Director _____				

ACN-250/CTA/051091

Report No. PTR-06	Project GMCC	Subsystem	Test Date 04/23/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT3.3 - Simultaneous WS Operations		
Test Step Description: Print IMCS reports.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: IMCS REPORTS CANNOT BE PRINTED.				
Detailed Description: IMCS reports cannot be printed to the network printer.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status				
1. _____ Date: ____/____/____ 2. _____ Date: ____/____/____				
Closure Description: _____ _____				
Approved:				
Test Director _____				

ACN-250/CTA/051091

Report No. PTR-07	Project GMCC	Subsystem	Test Date 04/23/91	Create Date 05/10/91						
Report By: C.Stewart		Test Sequence ID DQT3.3 - Simultaneous WS Operations								
Test Step Description: Print MMS reports.										
<table> <tr> <td>Category of Failure (circle one)</td> <td>I critical</td> <td>II major</td> <td>III minor</td> <td>IV annoyance</td> <td>V other</td> </tr> </table>					Category of Failure (circle one)	I critical	II major	III minor	IV annoyance	V other
Category of Failure (circle one)	I critical	II major	III minor	IV annoyance	V other					
Brief Description: MMS REPORT PRINTING PROBLEM.										
Detailed Description: MMS reports can only be printed by the network printer when the MMS window or session from which the print is issued is exited.										
Test Engineer <u>Craig Stewart</u>										
Disposition Instructions:										
Follow-up Status 1. _____ Date: <u> </u> / <u> </u> / <u> </u> 2. _____ Date: <u> </u> / <u> </u> / <u> </u> Closure Description: _____ _____ Date: <u> </u> / <u> </u> / <u> </u>										
Approved: Test Director _____										

Report No. PTR-08	Project GMCC	Subsystem	Test Date 04/23/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT3.4 - GMCC Operational Control		
Test Step Description: Monitoring/Unmonitoring data points.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: IMCS PROBLEM - RANDOM ERROR.				
Detailed Description: When monitoring or unmonitoring more than one data point, a random error occurred advising the user to notify the MPS Supervisor.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status				
1. _____ Date: <u> </u> / <u> </u> / <u> </u> 2. _____ Date: <u> </u> / <u> </u> / <u> </u>				
Closure Description: _____ _____				
Approved: Test Director _____				

ACN-250/CTA/051091

Report No. PTR-09	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91						
Report By: C.Stewart		Test Sequence ID DQT2.1 - Local Area Network Checkout								
Test Step Description: Enter an invalid password.										
<table border="0"> <tr> <td>Category of Failure (circle one)</td> <td>I critical</td> <td>II major</td> <td>III minor</td> <td>IV annoyance</td> <td>V other</td> </tr> </table>					Category of Failure (circle one)	I critical	II major	III minor	IV annoyance	V other
Category of Failure (circle one)	I critical	II major	III minor	IV annoyance	V other					
Brief Description: INVALID PASSWORD SECURITY.										
Detailed Description: Even though an incorrect password was entered, the message "DQE was logged on successfully" was displayed and network access was allowed.										
Test Engineer <u>Craig Stewart</u>										
Disposition Instructions:										
Follow-up Status										
1. _____				Date: _____						
2. _____				_____						
Closure Description:										

Approved:										
Test Director _____										

ACN-250/CTA/051091

Report No. PTR-10	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91
Report By: C.Stewart		Test Sequence ID DQT3.3 - Simultaneous WS Operations		
Test Step Description: Run second Constant Monitor.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: CONSTANT BEEP OCCURRED WITH TWO CONSTANT MONITORS RUNNING AT ONCE.				
Detailed Description: Opening two IMCS windows and running simultaneous Constant Monitors caused the workstation to issue a constant beep. The beep was loud enough to cause aggravation.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status				
1. _____				Date: ____/____/____
2. _____				____/____/____
Closure Description: _____ _____				
Approved: Test Director _____				

Report No. PTR-11	Project GMCC	Subsystem	Test Date 04/22/91	Create Date 05/10/91
Report By: C. Stewart		Test Sequence ID DQT2.6 - MicroGate Emulator Checkout		
Test Step Description: Running an IMCS session.				
Category of Failure I II III IV V (circle one) critical major minor annoyance other				
Brief Description: 25TH LINE NOT DISPLAYED.				
Detailed Description: Within an IMCS session, there is no display of 25th line real-time alerts.				
Test Engineer <u>Craig Stewart</u>				
Disposition Instructions:				
Follow-up Status 1. _____ Date: ____/____/____ 2. _____ Date: ____/____/____				
Closure Description: _____ _____				
Approved: Test Director _____				